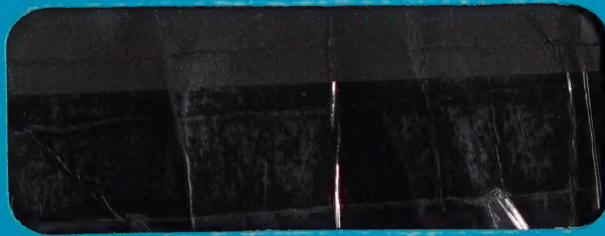


# Operating and Service Manual



**GOULD**

*An Electrical/Electronics Company*





An Electrical/Electronics Company

MANUAL PART NO.  
2007-804XXX-XX

## 2400 SERIES RECORDERS ALL MODELS

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**Gould Inc., Instruments Division**  
3631 Perkins Avenue, Cleveland, Ohio 44114

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# **WARNING**

**IN PATIENT CARE APPLICATIONS**

**ISOLATION TRANSFORMER**

**(Gould P.N. 882895-3(115V),-4(230V) or equal)**

**MUST BE CONNECTED BETWEEN**

**POWER SOURCE AND RECORDER**



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### CURRENT EQUIPMENT:

The Gould Instruments Division's products as shown in the Current Equipment Catalog are warranted for a period of one year from date of shipment to original purchaser. They are warranted to conform to the applicable published specifications in effect at the time of shipment, and to be free from any defects in material or manufacture when used with recommended Gould associated equipment and Gould chart paper. LIABILITY OF THE GOULD INSTRUMENTS DIVISION UNDER SUCH WARRANTY IS LIMITED TO SERVICING OR REPLACING DEFECTIVE PARTS EXCEPT PENS, STYLI, FUSES AND BATTERIES AND DOES NOT INCLUDE CALIBRATION AND MINOR MAINTENANCE AS OUTLINED IN GOULD OPERATING MANUALS. (Exception: The thermal pen in the 110 Strip Chart Recorder is guaranteed for life.) IN NO EVENT SHALL THE GOULD INSTRUMENTS DIVISION BE LIABLE UNDER ANY CIRCUMSTANCES, FOR ANY LOSS OF PROFITS OR OTHER CONTINGENT, CONSEQUENTIAL OR SPECIAL DAMAGES. Units are to be returned transportation prepaid by the buyer. The Gould Instruments Division will have the right of final determination of the cause and existence of a defect under this warranty. This warranty shall not apply to any products which have been subjected to misuse, improper installation, repair, alteration, neglect, accident, inundation, fire or operation outside their published maximum ratings. THE FOREGOING WARRANTY IS EXCLUSIVE AND EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES WHETHER EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS AND OF ANY OTHER OBLIGATION AND SHALL CONSTITUTE THE SOLE REMEDY OF THE BUYER AND SOLE LIABILITY OF THE SELLER.

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If a defect occurs:

1. Notify your nearest ID Service Center (see below), giving full details of the difficulty, and include the model number, type number, and serial number. On receipt of this information, service data or shipping authorization and instructions will be forwarded to you.
2. On receipt of the shipping authorization, forward the instrument prepaid to location indicated on shipping authorization.

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Phone: 909-10-67

**GOULD ADVANCE**  
Roebuck Road  
Hainault, Essex, England  
Phone: 01-500-1000



VALIDATION/REGISTRATION OF GOULD INC. WARRANTY

To validate and register your Gould Inc. product warranty, please complete and return this card within 30 days.

User's Name: \_\_\_\_\_ Title \_\_\_\_\_ Model No.: \_\_\_\_\_  
 Company: \_\_\_\_\_ Division: \_\_\_\_\_ Serial No.: \_\_\_\_\_  
 Address: \_\_\_\_\_ No. Employees \_\_\_\_\_  
 This Location: 0-100 100-250 250-500 500+ Date Received: \_\_\_\_\_  
 City: \_\_\_\_\_ State: \_\_\_\_\_ Zip \_\_\_\_\_ Condition:  
☐ Good ☐ Fair ☐ Poor

Please describe type of application in which this instrument will be used: \_\_\_\_\_

Comments or other features you would like to see incorporated into this unit: \_\_\_\_\_

Please encircle the appropriate letter in each of the following categories:

| 1<br>USER'S<br>Principal Job Function<br>(Select One)      | 2<br>USER'S<br>Background/Professional<br>Training (Select One) | 3<br>Primary End Product or Service<br>Performed at This Location<br>(Select One) |
|------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------------------------|
| A Design/Development Engr'g                                | A Chemist/Chemical Engineer                                     | A Research & Engr'g (Industrial)                                                  |
| B Engineering Services<br>(Evaluation/Q.C./Test/Standards) | B Electrical Engineer                                           | B Research & Engr'g (Life Sciences)                                               |
| C Basic Research                                           | C Electronic Engineer                                           | C Gov't Agency/Military                                                           |
| D Life Sciences Research                                   | D Mechanical Engineer                                           | D Hospital/Health Service                                                         |
| E Health Care                                              | E Physicist                                                     | E Mining/Drilling/Construction                                                    |
| F Lab Asst./Technician/Draftsman                           | F Geologist                                                     | F Fabricated Metals/Ordnance                                                      |
| G Manufacturing/Production                                 | G Biomedical/Clinical Eng.                                      | G Primary Metals                                                                  |
| H Other (Please specify)                                   | H Medical/Professional                                          | H Automobile & Other Vehicles                                                     |
|                                                            | I Other (Please specify)                                        | I Aircraft/Missiles/Space & Ground<br>Support Equipment                           |
|                                                            |                                                                 | J Railroads & Transit                                                             |
|                                                            |                                                                 | K Chemicals/Petrochemicals                                                        |
|                                                            |                                                                 | L Rubber/Plastic Products                                                         |
|                                                            |                                                                 | M Computers & Business Machines                                                   |
|                                                            |                                                                 | N Communications Systems & Equipment                                              |
|                                                            |                                                                 | O University/School                                                               |
|                                                            |                                                                 | P Utility                                                                         |
|                                                            |                                                                 | Q Industrial Controls/Systems/Equipment                                           |
|                                                            |                                                                 | R Components & Sub Assemblies                                                     |
|                                                            |                                                                 | S Electrical Equipment                                                            |
|                                                            |                                                                 | T Electronic Equipment/Instruments                                                |
|                                                            |                                                                 | U Other Mfg. (Please specify)                                                     |
|                                                            |                                                                 | V. Other Service (Please specify)                                                 |

| 4<br>Equipment User Recommends, Specifies, and/or Buys<br>(Select all that apply) |                                         |
|-----------------------------------------------------------------------------------|-----------------------------------------|
| A Signal Sources                                                                  | H 5"-10" Low-Speed Strip Chart Recorder |
| B Logic Analyzers                                                                 | I Multimeter                            |
| C Oscilloscopes                                                                   | J Data Acquisition Systems              |
| D Waveform Recorders                                                              | K Light Beam Recorder                   |
| E XY Recorders                                                                    | L Minicomputers                         |
| F Oscillographs                                                                   | M IEEE 488 Based Instruments            |
| G Amplifiers/ Signal Conditioners                                                 |                                         |

Thank you for providing the above information. We will use this data to continue to develop high performance products to meet your needs.

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**Instruments Division**  
**3631 Perkins Avenue**  
**Cleveland, Ohio 44114**

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page locations of Parts Illustrations and Tables.



## SECTION I

### GENERAL INFORMATION

#### 1.1 SCOPE

This manual describes the Gould 2000 Series Analog Recorders (Figure 1-1), and provides instructions for installation, operation, troubleshooting, and maintenance. Theory of operation and calibration procedures are also provided. An illustrated parts breakdown is located in the rear of the manual.

Instructions for preamplifiers which may be used with these recorders are contained in their own applicable instruction manuals.

#### 1.2 DESCRIPTION

The 2000 Series is a family of high performance analog recorders. They are self-contained units housed in 250mm or 380mm mainframe chassis to accommodate 2 to 6 isolated recording channels. Each recording channel incorporates frictionless feedback sensors for closed loop control of the pen at high speeds.

Standard to each model are chart speeds of 5, 10, 25, 50, 100, and 200 millimeters per second plus a

divide by 100 or 60 (as ordered) for each writing speed. All chart writing speeds are electrically selected by pushbuttons on the front panel. Two standard event markers are provided and are located on the right and left hand margins.

The 2000 Series uses a pressurized ink writing system. The pressurized inking system uses fast drying ink which is applied to specially coated chart paper. The ink is contained in disposable plastic cartridges which can be replaced in minutes. Pen motion is rectilinear.

#### 1.3 MODEL NUMBERING SYSTEMS

The model number of the 2000 Series Recorder designates mounting type, chassis (mainframe) size, number of recording channels, preamplifier cage configuration, type of writing system and variations. The tables on the pages that follow "Specifications", and "Supplies and Accessories", describe the 2000 Series model numbering systems. Appropriate recorder outline dimensionals accompany each model numbering table.



bi1533

FIGURE 1-1 GOULD 2000 SERIES RECORDER



## 1.4 SPECIFICATIONS

### a. General

|                                           |                                                                                                             |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Number of Analog Channels . . . . .       | Two to Six (Depending upon Model Number).                                                                   |
| Number of Event Marker Channels . . . . . | Left & Right Margin. Additional are Optional.                                                               |
| Channel Span . . . . .                    | 50 or 100 mm (Depending upon Model Number).                                                                 |
| Trace Presentation . . . . .              | Rectilinear                                                                                                 |
| Trace Width . . . . .                     | 0.01 inch nominal at 5mm/sec chart speed.                                                                   |
| Marking Method . . . . .                  | Pressured ink.                                                                                              |
| Marking Fluid Capacity . . . . .          | One or two one-ounce replaceable throw away cartridges<br>(sufficient for one year under normal operation). |
| Chart Speeds . . . . .                    | 5, 10, 25, 50, 100, and 200 mm/sec plus divide by 60 or 100.                                                |
| Chart Speed Accuracy . . . . .            | ±0.5% synchronous with line frequency.                                                                      |
| Chart Length . . . . .                    | 275 feet (83 meters)                                                                                        |
| Chart Width . . . . .                     | 250mm and 380mm                                                                                             |
| Divisions per Channel . . . . .           | 50 Divisions on 50 mm Channels<br>100 Divisions on 100 mm Channels                                          |
| Time Lines . . . . .                      | Every mm, accentuated at 5 and 100mm.                                                                       |
| Chart Travel Direction . . . . .          | Top to Bottom                                                                                               |
| Paper Discharge . . . . .                 | Front                                                                                                       |
| Chart Wander . . . . .                    | ± 0.25 mm                                                                                                   |
| Operating Temperature Range . . . . .     | 0° to +50° C (+32° to +122° F)                                                                              |
| Storage Temperature Range . . . . .       | -40° to +70° C (-40° to +158° F)                                                                            |
| Humidity . . . . .                        | 95% at 32° C (+90° F) Non-Condensing                                                                        |
| Vibration and Shock . . . . .             | Standard Commercial Practice.                                                                               |
| Principle Dimensions . . . . .            | Refer to Outline Dimensions (Following Model<br>Numbering System Tables).                                   |



## 1.4 SPECIFICATIONS (Cont'd)

## b. Electrical

|                                                                        |                                                                                                                                                                                                                                                                                                            |
|------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Input Circuit .....                                                    | Single ended, floating (Phone jack or preamp connector)                                                                                                                                                                                                                                                    |
| Input Impedance .....                                                  | 100K ohms $\pm 1\%$ (Recorder without Preamplifiers)                                                                                                                                                                                                                                                       |
| Input Signal .....                                                     | $\pm 2.5V$ for full scale deflection of 50,<br>or 100 mm channels.                                                                                                                                                                                                                                         |
| Frequency Response .....                                               | 100 div. @ 100 millimeter amplitude: dc to 30Hz +1 div.<br>50 div. @ 50 millimeter amplitude: dc to 50Hz +1 div.<br>40 div. @ 40 millimeter amplitude: dc to 55Hz +1 div.<br>10 div. @ 10 millimeter amplitude: dc to 125Hz +1 div., down<br>less than 3dB @ 140Hz.                                        |
| Rise Time (10% to 90% full scale with<br>less than 1% overshoot) ..... | At 100 millimeter amplitude: less than 8 milliseconds<br>At 50 millimeter amplitude: less than 5 milliseconds<br>At 40 millimeter amplitude: less than 4 milliseconds                                                                                                                                      |
| Non-Linearity .....                                                    | $\pm 0.35\%$ of full scale                                                                                                                                                                                                                                                                                 |
| Pen Position Control .....                                             | Infinitely adjustable $\pm 5$ volts d-c.<br>One per channel.                                                                                                                                                                                                                                               |
| Maximum Allowable Signal Input Voltage<br>to Avoid Damage .....        | $\pm 50$ volts dc or peak ac (recorder without preamplifiers).                                                                                                                                                                                                                                             |
| Maximum Safe Common Mode Voltage .....                                 | 500 volts dc or peak ac.                                                                                                                                                                                                                                                                                   |
| Common Mode Rejection Ratio .....                                      | 60 dB at 60Hz ( $R_s = 1$ kilohm, without preamplifiers).<br>80 dB at dc ( $R_s = 1$ kilohm, without preamplifiers)                                                                                                                                                                                        |
| Signal Limiters .....                                                  | Built-in adjustable electronic and mechanical                                                                                                                                                                                                                                                              |
| Zero-Line Instability (Drift) After<br>15 Minute Warm-Up .....         | $\pm 0.1\%$ of full scale for 24 hours<br>$\pm 0.025\%$ of full scale per $^{\circ}C$<br>$\pm 0.10\%$ of full scale for $\pm 10\%$ line voltage change                                                                                                                                                     |
| Gain Instability .....                                                 | $\pm 0.1\%$ of reading for 24 hours<br>$\pm 0.05\%$ of reading per $^{\circ}C$<br>$\pm 0.05\%$ of reading for $\pm 10\%$ line voltage change                                                                                                                                                               |
| Remote Chart Drive Start/Stop<br>(Standard on all Recorders) .....     | Actuated by an external switch closure at any<br>preselected chart speed.                                                                                                                                                                                                                                  |
| Internal Timer (Standard on all<br>Recorders) .....                    | Produces 40 millisecond duration pulses at programmable<br>repetition rates depending upon line frequency as follows:<br>Line Frequency<br>50 or 60 Hz<br>400 Hz<br>Programmable Repetition Rates<br>0.1, 1, 10 and 100 second; 0.01, 0.1 and 1 minute<br>0.1, 1 and 10 second; 0.001, 0.01 and 0.1 minute |
| Power Consumption .....                                                | 50 to 60Hz: 160VA +50VA per channel (100W+41W per<br>channel) 400Hz: 300VA +50VA per channel (200W+41 W per channel).                                                                                                                                                                                      |



**1.5 SUPPLIES AND ACCESSORIES****a. Supplies****Chart Paper (All Models)**

High Contrast, Kromekote (275 feet) 1 mm time line

**2400 Series - 250 mm wide**

|                                                           |             |
|-----------------------------------------------------------|-------------|
| 2-100 mm channels .....                                   | 11-2923-34  |
| 1-100 mm channel, 2-50 mm channels .....                  | 11-2933-30  |
| 4-50 mm channels .....                                    | 11-2943-30  |
| 2-100 mm channels, Semi-Perforated .....                  | 11-2923-301 |
| 1-100 mm channel, 2-50 mm channels, Semi-Perforated ..... | 11-2933-300 |
| 4-50 mm channels, Semi-Perforated .....                   | 11-2943-300 |

**2600 Series - 380 mm wide (15 inches)**

|                                          |             |
|------------------------------------------|-------------|
| 3-100 mm channels .....                  | 11-2933-31  |
| 1-100 mm channel, 4-50 mm channels ..... | 11-2953-30  |
| 6-50 mm channels, Semi-Perforated .....  | 11-2963-300 |

|                                                                                          |             |
|------------------------------------------------------------------------------------------|-------------|
| Drive Amplifier Extender Card .....                                                      | 887526      |
| Analog Pen (Includes ink tube, lapping paper, and pen pressure adjustment wrench.) ..... | 11-2823-42  |
| Event Marker Pen .....                                                                   | 267884-5    |
| Ink Cartridge (1oz) .....                                                                | 11-2730-01  |
| Pen Pressure Adjustment-Wrench .....                                                     | 1-120922-18 |
| Band, Penmotor .....                                                                     | 684999      |
| Gram Gage .....                                                                          | 240610-910  |
| Tube Replacement Tool .....                                                              | 267528      |

**b. Accessories****Starter Kits**

All starter kits include 12 rolls of high contrast chart paper, gram gage, one analog pen, lapping paper and pen pressure adjustment wrench. Below are starter kit model numbers.

|                                                      |            |
|------------------------------------------------------|------------|
| 1-100 mm and 2-50 mm channels .....                  | 11-6250-03 |
| 4-50 mm channels .....                               | 11-6250-04 |
| 2-100 mm channels .....                              | 11-6250-05 |
| 6-50 mm channels, Semi-Perforated .....              | 11-6250-10 |
| 3-100 mm channels .....                              | 11-6250-11 |
| 1-100 mm and 4-50 mm channels .....                  | 11-6250-12 |
| 1-100 mm and 2-50 mm channels, semi-perforated ..... | 11-6250-16 |
| 4-50 mm channels, semi-perforated .....              | 11-6250-17 |
| 2-100 mm channels, semi-perforated .....             | 11-6250-18 |



## Rack Mounting Kits (For Conversion of Portable Units)

|                                          |            |
|------------------------------------------|------------|
| 2400 Series without Preamps . . . . .    | 11-1202-11 |
| 2400 Series with 2 Preamp cage . . . . . | 11-1202-12 |
| 2400 Series with 4 Preamp cage . . . . . | 11-1202-13 |
| 2600 Series without Preamps . . . . .    | 11-1202-15 |

## Mobile Carts

|                                        |            |
|----------------------------------------|------------|
| 2400 Series (250 mm Chassis) . . . . . | 11-6405-01 |
|----------------------------------------|------------|

## Chart Takeups

|                                         |            |
|-----------------------------------------|------------|
| 2400 Series (250 mm Chassis) . . . . .  | 11-6402-11 |
| 2600 Series (380 mm Chassis ) . . . . . | 11-6402-12 |

|                                                       |        |
|-------------------------------------------------------|--------|
| Interchannel Event Marker (without harness) . . . . . | 887181 |
|-------------------------------------------------------|--------|

|                                      |            |
|--------------------------------------|------------|
| 2400 Series (with harness) . . . . . | 11-2123-35 |
| 2600 Series (with harness) . . . . . | 11-2123-36 |

|                               |            |
|-------------------------------|------------|
| Blank Preamp Module . . . . . | 13-4615-09 |
|-------------------------------|------------|

|                                        |        |
|----------------------------------------|--------|
| Preamp Panel Assembly, Blank . . . . . | 887005 |
|----------------------------------------|--------|

|                                                                                  |                                         |
|----------------------------------------------------------------------------------|-----------------------------------------|
| 500 Watt Portable Isolation Transformer (for patient care applications). . . . . | 882895-3 (115Vac)<br>882895-4 (230 Vac) |
|----------------------------------------------------------------------------------|-----------------------------------------|



TABLE 1-1 2400 SERIES MODEL NUMBERING SYSTEM

| MODEL NUMBER     | CODE DESCRIPTION                                                                            |
|------------------|---------------------------------------------------------------------------------------------|
| 2007 - XXXX - XX |                                                                                             |
|                  | <b>Operating Voltages</b>                                                                   |
|                  | 00 115V $\pm$ 10%, 60Hz, divide by 100 chart speeds                                         |
|                  | 04 115V $\pm$ 10%, 400 Hz, divide by 100 chart speeds                                       |
|                  | 05 115V $\pm$ 10%, 50Hz, divide by 100 chart speeds                                         |
|                  | 06 230V $\pm$ 10%, 50Hz, divide by 100 chart speeds                                         |
|                  | 10 115V $\pm$ 10%, 60Hz, divide by 60 chart speeds                                          |
|                  | 14 115V $\pm$ 10%, 400 Hz, divide by 60 chart speeds                                        |
|                  | 15 115V $\pm$ 10%, 50 Hz, divide by 60 chart speeds                                         |
|                  | 16 230V $\pm$ 10%, 50Hz, divide by 60 chart speeds                                          |
|                  | <b>Type of Mounting and Preamplifier Cage Configuration</b>                                 |
|                  | 00 Portable case for recorder only                                                          |
|                  | 02 Portable case & two-preamp cage                                                          |
|                  | 04 Portable case & four-preamp cage                                                         |
|                  | 10 Rack mounting kit & shipping frame for recorder only                                     |
|                  | 12 Rack mounting kit, two-preamp cage & shipping frame                                      |
|                  | 14 Rack mounting kit, four-preamp cage & shipping frame                                     |
|                  | 20 Rack mounting kit & vertical cabinet for recorder only                                   |
|                  | 22 Rack mounting kit, two-preamp cage & vertical cabinet                                    |
|                  | 24 Rack mounting kit, four-preamp cage & vertical cabinet                                   |
|                  | 30 Rack mounting kit, shipping frame & 500uA power kit for recorder only                    |
|                  | 32 Rack mounting kit, two-preamp cage, shipping frame, & 500uA power kit                    |
|                  | 34 Rack mounting kit, four-preamp cage, shipping frame, & 500uA power kit                   |
|                  | 40 Rack mounting kit, vertical cabinet & 500uA power kit for recorder only                  |
|                  | 42 Rack mounting kit, two-preamp cage, vertical cabinet & 500uA power kit                   |
|                  | 44 Rack mounting kit, four-preamp cage, vertical cabinet & 500uA power kit                  |
|                  | 50 Rack mounting kit, shipping frame & 30uA power kit for recorder only                     |
|                  | 52 Rack mounting kit, two-preamp cage, shipping frame & 30uA power kit                      |
|                  | 54 Rack mounting kit, four-preamp cage, shipping frame & 30uA power kit                     |
|                  | 60 Rack mounting kit, vertical cabinet & 30uA power kit for recorder only                   |
|                  | 62 Rack mounting kit, two-preamp cage, vertical cabinet & 30uA power kit                    |
|                  | 64 Rack mounting kit, four-preamp cage, vertical cabinet & 30uA power kit                   |
|                  | 70 Rack mounting kit, recorder only                                                         |
|                  | 72 Rack mounting kit, two-preamp cage                                                       |
|                  | 74 Rack mounting kit, four-preamp cage                                                      |
|                  | <b>Number of Channels</b>                                                                   |
|                  | 42 Two 100 millimeter channels, chassis asm., drive amps & timer                            |
|                  | 43 One 100 millimeter channel, two 50 millimeter channels, chassis asm., drive amps & timer |
|                  | 44 Four 50 millimeter channels, chassis asm., drive amps & timer                            |







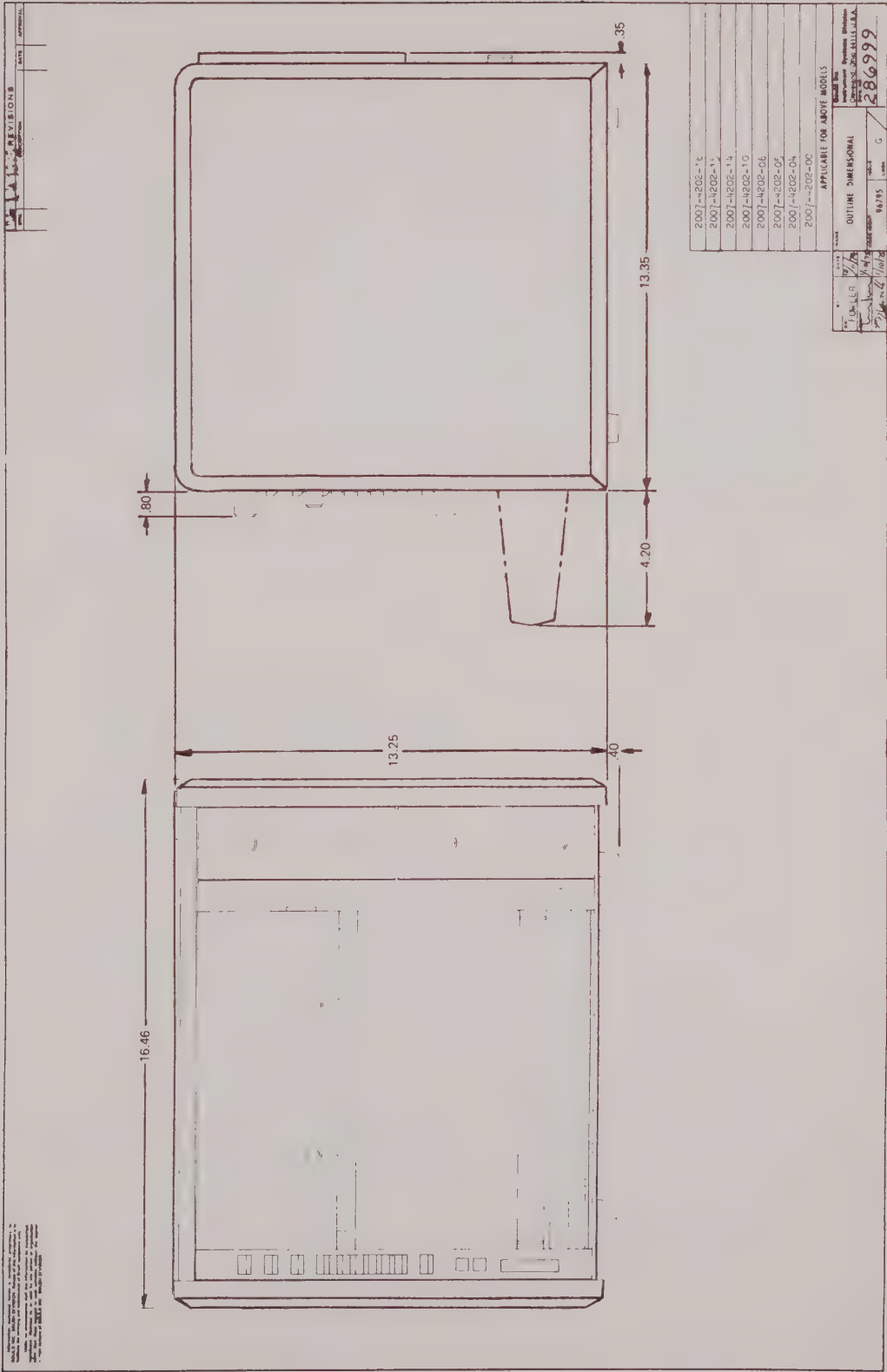


FIGURE 1-3 OUTLINE DIMENSIONS – 2400 SERIES WITH 2 PREAMPS



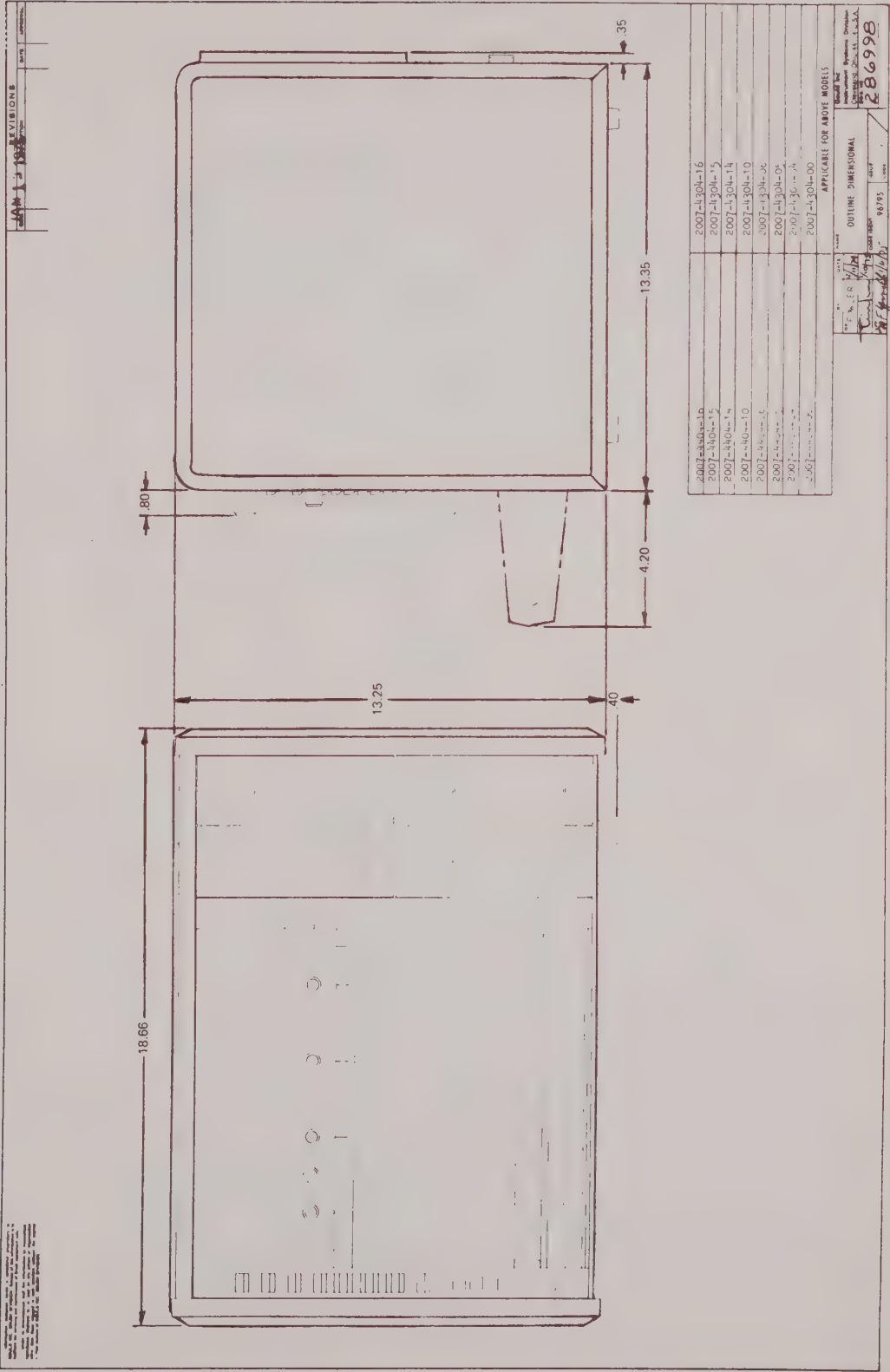


FIGURE 1-4 OUTLINE DIMENSIONS — 2400 SERIES WITH 3 or 4 PREAMPS



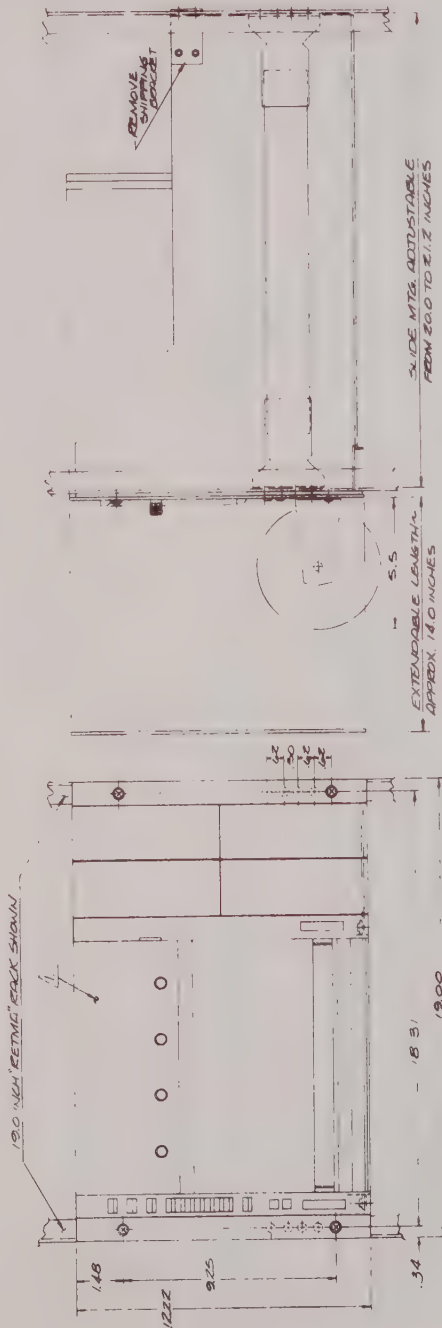


FIGURE 1-5 OUTLINE DIMENSIONS 2400 RACK MOUNT



TABLE 1-2 2600 SERIES MODEL NUMBERING

## MODEL NUMBER

2007 - XXXX - XX

**Operating Voltages**

|    |                                              |
|----|----------------------------------------------|
| 00 | 115V +10%, 60Hz, divide by 100 chart speeds  |
| 04 | 115V +10%, 400Hz, divide by 100 chart speeds |
| 05 | 115V +10%, 50Hz, divide by 100 chart speeds  |
| 06 | 230V +10%, 50Hz, divide by 100 chart speeds  |
| 10 | 115V +10%, 60Hz, divide by 60 chart speeds   |
| 14 | 115V +10%, 400Hz, divide by 60 chart speeds  |
| 15 | 115V +10%, 50Hz, divide by 60 chart speeds   |
| 16 | 230V +10%, 50Hz, divide by 60 chart speeds   |

**Type of Mounting and Preamplifier Cage and Frame Configuration**

|    |                                                                                                                           |
|----|---------------------------------------------------------------------------------------------------------------------------|
| 00 | Portable case for recorder only                                                                                           |
| 04 | Portable case and four preamp cage (for 3-100mm channel recorder only)                                                    |
| 06 | Portable case and six preamp cage (for 1-100mm & 4-50 mm channel recorder and 6-50 mm channel recorders only)             |
| 10 | Rack mounting kit and shipping frame for recorder only                                                                    |
| 18 | Rack mounting kit, 8 channel preamp frame for 4600 Series preamps and shipping frame                                      |
| 20 | Rack mounting kit and vertical cabinet for recorder only                                                                  |
| 28 | Rack mounting kit, 8 channel preamp frame for 4600 Series preamps and vertical cabinet                                    |
| 30 | Rack mounting kit, shipping frame and 500 microampere power kit for recorder only                                         |
| 38 | Rack mounting kit, 8 channel preamp frame for 4600 Series preamps, shipping frame and 500 microampere power kit           |
| 40 | Rack mounting kit, vertical cabinet and 500 microampere power kit for recorder only                                       |
| 48 | Rack mounting kit, 8 channel preamp frame for 4600 Series preamps, vertical cabinet and 500 microampere power kit         |
| 50 | Rack mounting kit, shipping frame and 30 microampere isolated power kit for recorder only                                 |
| 58 | Rack mounting kit, 8 channel preamp frame for 4600 Series preamps, shipping frame and 30 microampere isolated power kit   |
| 60 | Rack mounting kit, vertical cabinet and 30 microampere isolated power kit for recorder only                               |
| 68 | Rack mounting kit, 8 channel preamp frame for 4600 Series preamps, vertical cabinet and 30 microampere isolated power kit |
| 70 | Rack mounting kit, recorder only                                                                                          |
| 78 | Rack mounting kit, 8 channel preamp frame for 4600 Series preamps                                                         |

**Number of Channels**

|    |                                                                                                       |
|----|-------------------------------------------------------------------------------------------------------|
| 63 | Three 100 millimeter channels, chassis assembly, drive amplifiers and timer                           |
| 65 | One 100 millimeter channel, four 50 millimeter channels, chassis assembly, drive amplifiers and timer |
| 66 | Six 50 millimeter channels, chassis assembly, drive amplifiers and timer                              |



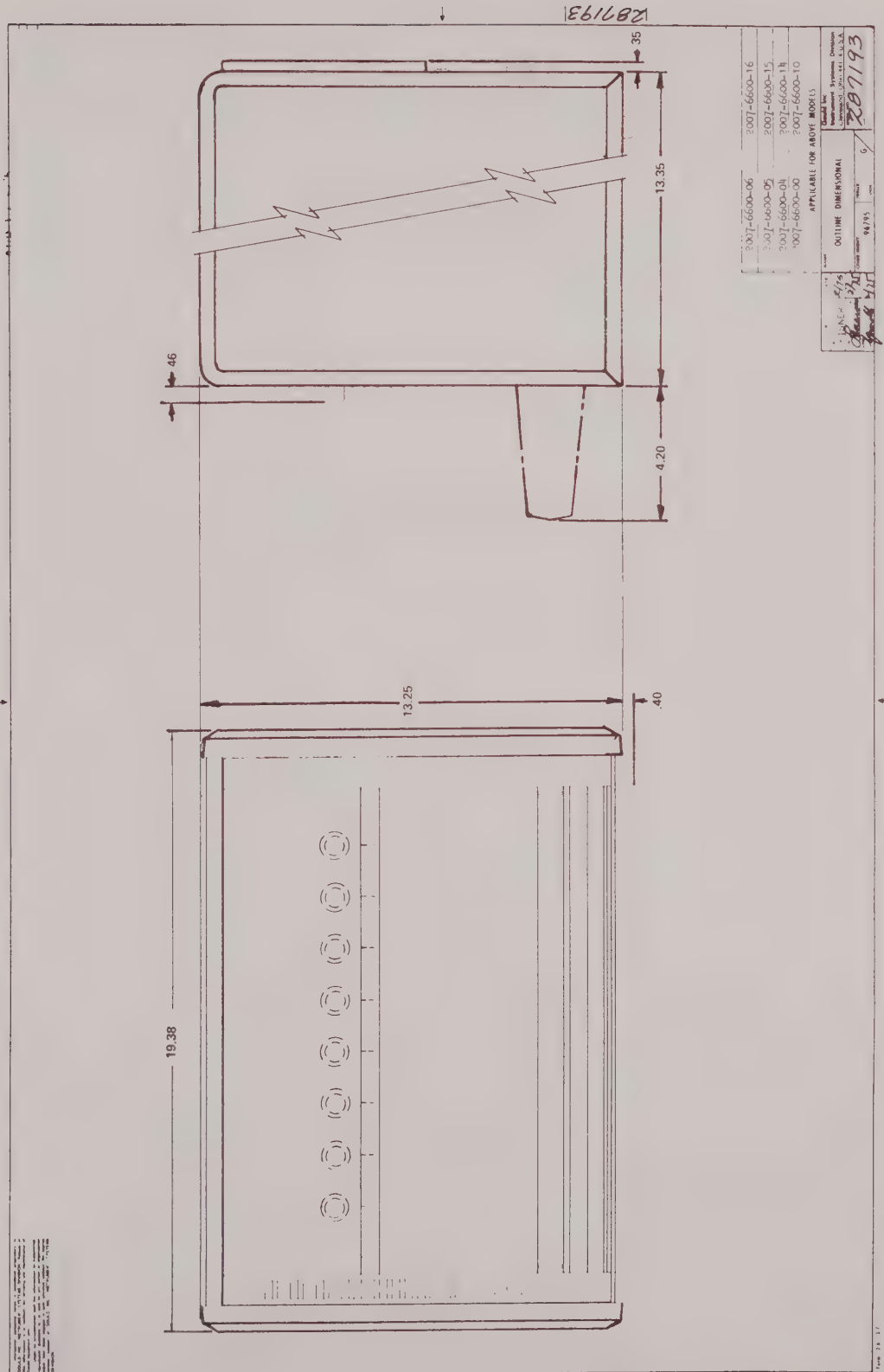


FIGURE 1-6 OUTLINE DIMENSIONS - 2600 SERIES



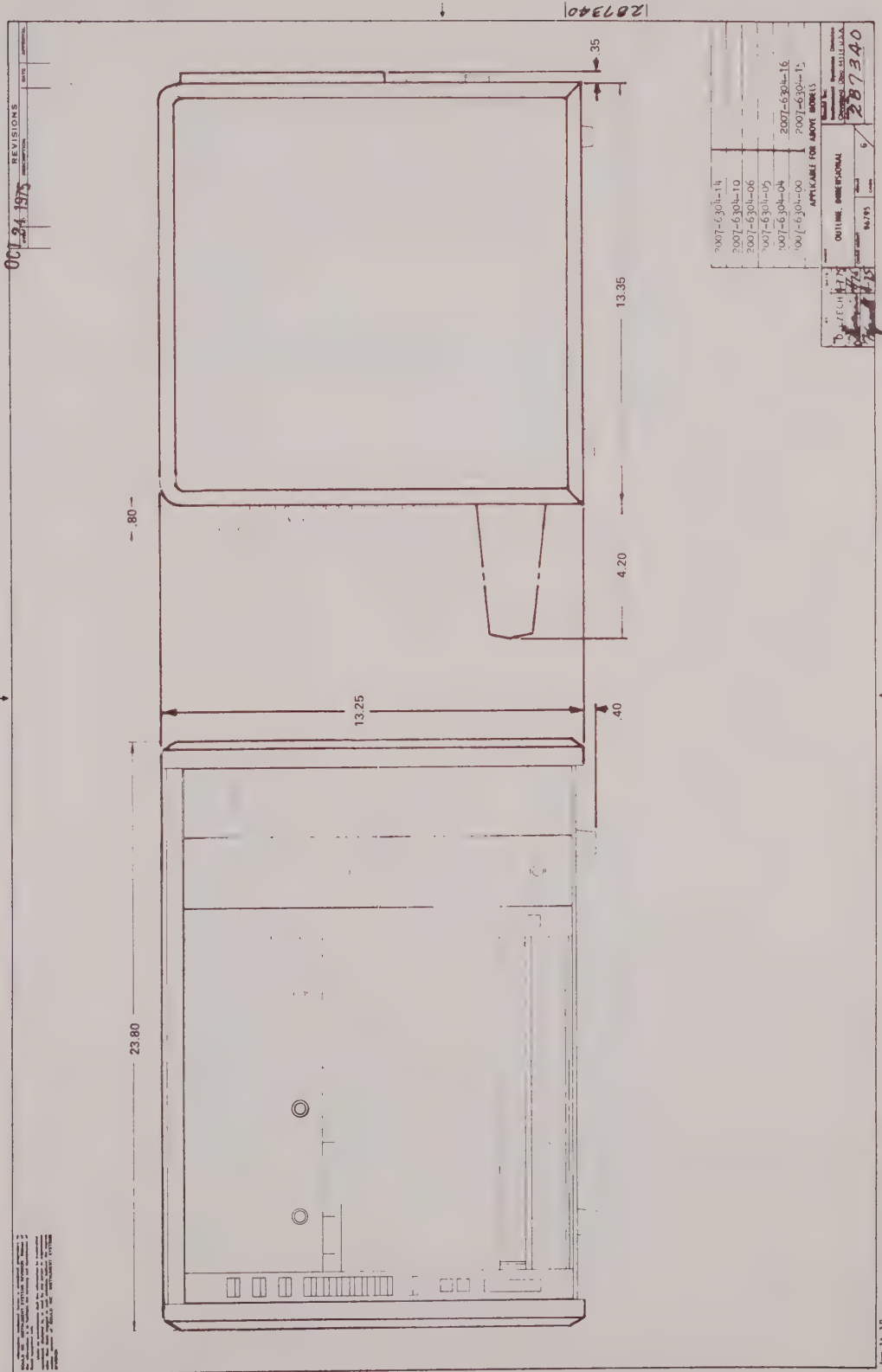


FIGURE 1-7 OUTLINE DIMENSIONS - 2600 SERIES WITH 3 PREAMPS



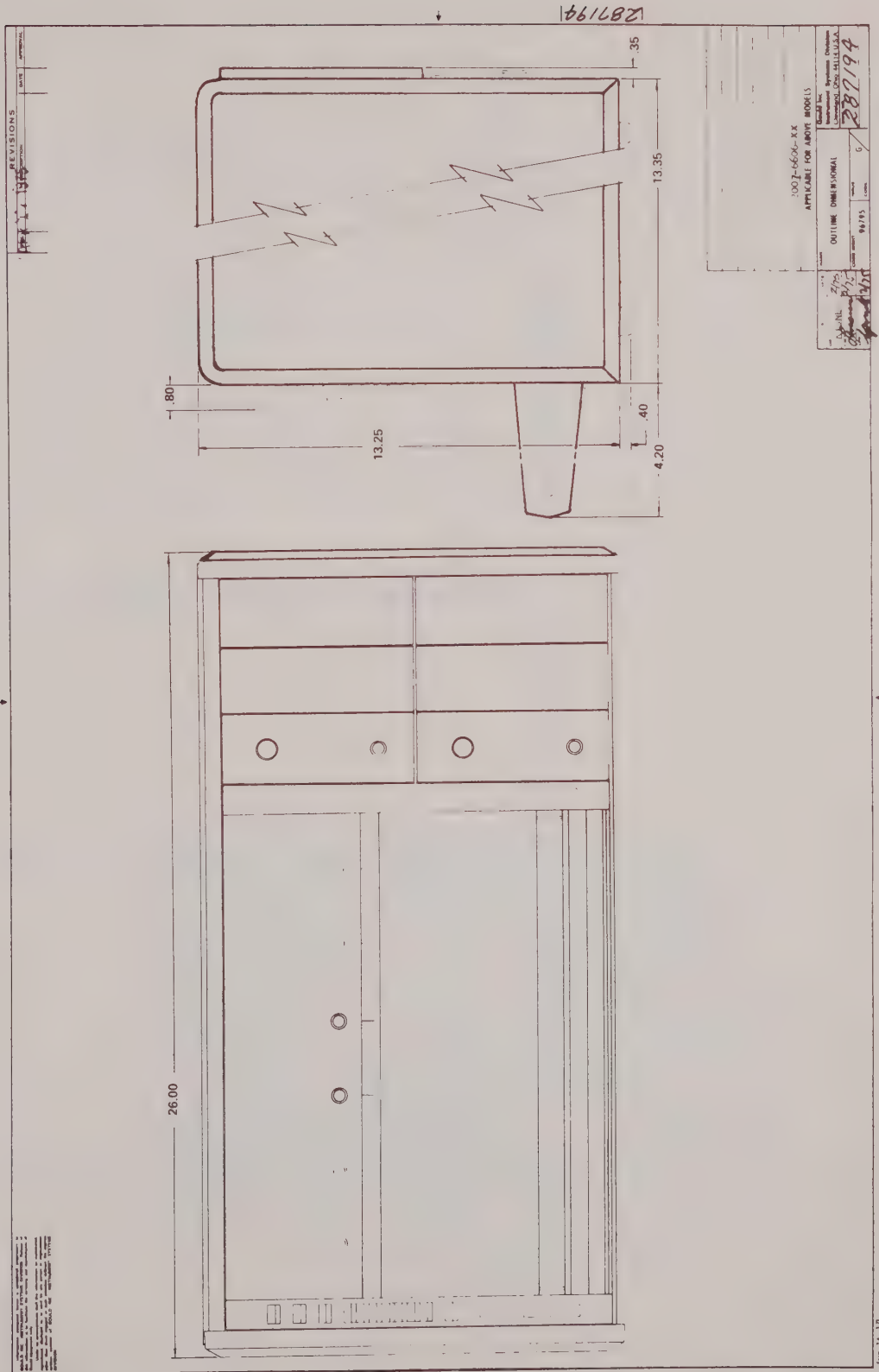


FIGURE 1-8 OUTLINE DIMENSIONS - 2600 SERIES WITH 5 or 6 PREAMPS



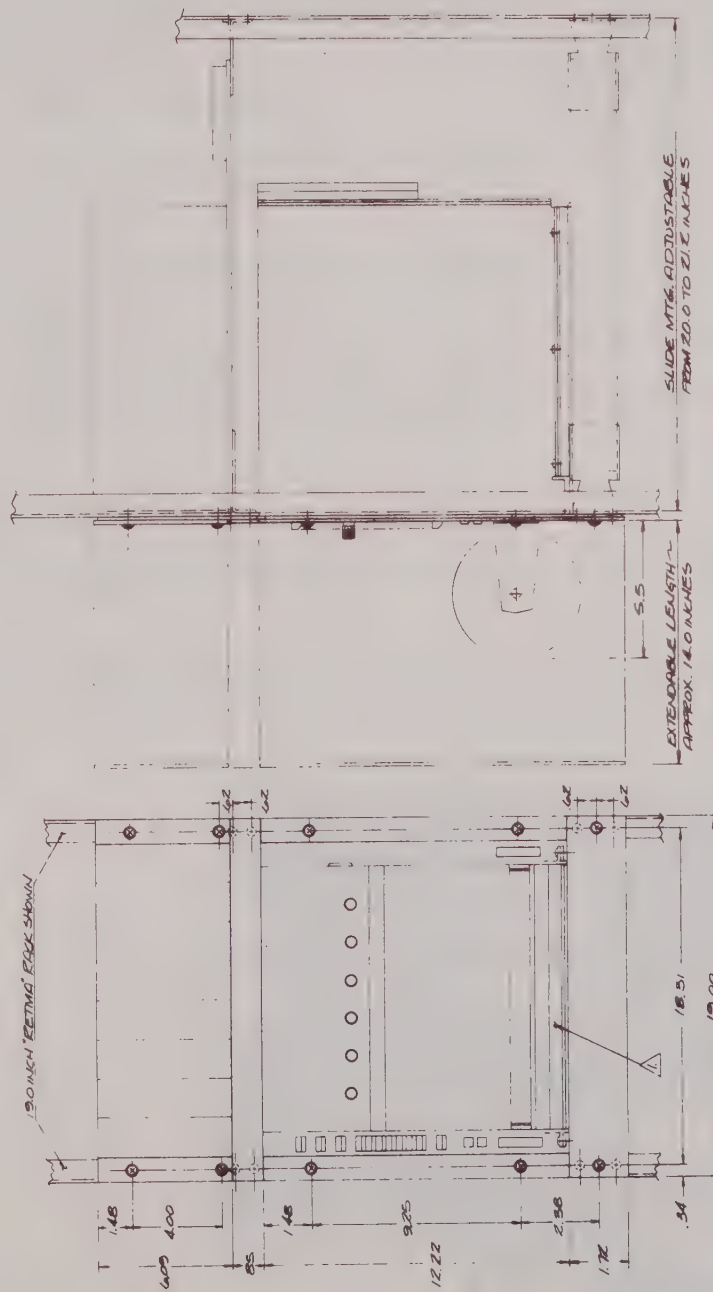


**FIGURE 1-9 OUTLINE DIMENSIONS 2600 RACK MOUNT**



## SECTION II

### INSTALLATION

#### 2.1 GENERAL

This section contains information necessary to put the recorder into service, including installation of optional equipment.

#### 2.2 SERVICE UPON RECEIPT

Before making signal connections and applying power to the recorder, the following service must be performed:

1. Remove sheet of chart paper from under pens and load roll of chart paper as described in Section VI.
2. Turn ON all ink solenoid valves. These are located behind the pen access cover. Raise cover by pulling out on bottom and sliding back into recorder. Turn on ink cartridges.
3. Remove top access cover and check ink supply. Ink cartridge(s) should be near full. Cover is removed pushing back with palm of hand, then lifting up.
4. Make sure POWER pushbutton is released (OFF).

#### 2.3 LINE VOLTAGE REQUIREMENTS

The last digit of the model number designates line voltage and frequency. Listed below are last digit of model number and line voltage and frequency required.

| DIGIT | LINE VOLTAGE & FREQUENCY |
|-------|--------------------------|
| 0     | 115 vac @ 60 Hz          |
| 4     | 115 vac @ 400 Hz         |
| 5     | 115 vac @ 50 Hz          |
| 6     | 230 vac @ 50 Hz          |

#### 2.4 ANALOG SIGNAL CONNECTIONS

##### a. Without Preamplifiers

On recorders not supplied with preamplifiers, signal input connections are made directly to pen drive amplifiers. Two phone jacks are provided on each drive amplifier. They are located on the rear of the recorder. (Figure 2-1 represents only the Signal Input Jacks (Drive Amp — Channel 1, etc.). Monitor Jacks are located directly above the Signal Input Jacks.) Use shielded cable (Belden 8422 or equal). Tip is high; ring is low; barrel is common.

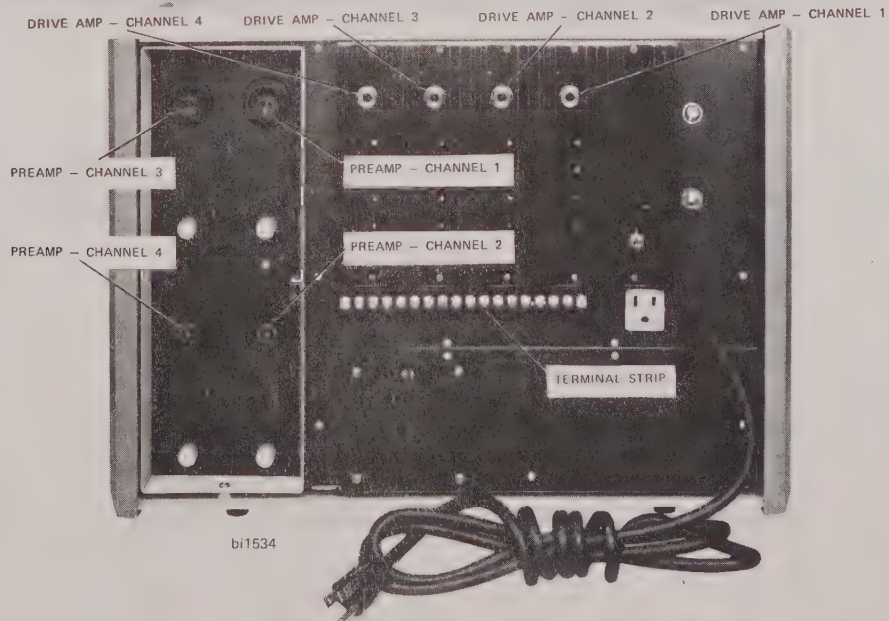


FIGURE 2-1. SIGNAL INPUT CONNECTIONS



**b. With Preamplifiers**

On recorders supplied with preamplifiers, signal input connections are made via a connector located in the preamplifier cage. Refer to applicable preamplifier manual for their signal input connections.

**2.5 EVENT MARKER INPUTS**

**a. Standard Event Markers**

Left and right markers are standard. Actuation is made by momentary switches on front panel or externally via the terminal strip located on recorder rear panel. External actuation may be

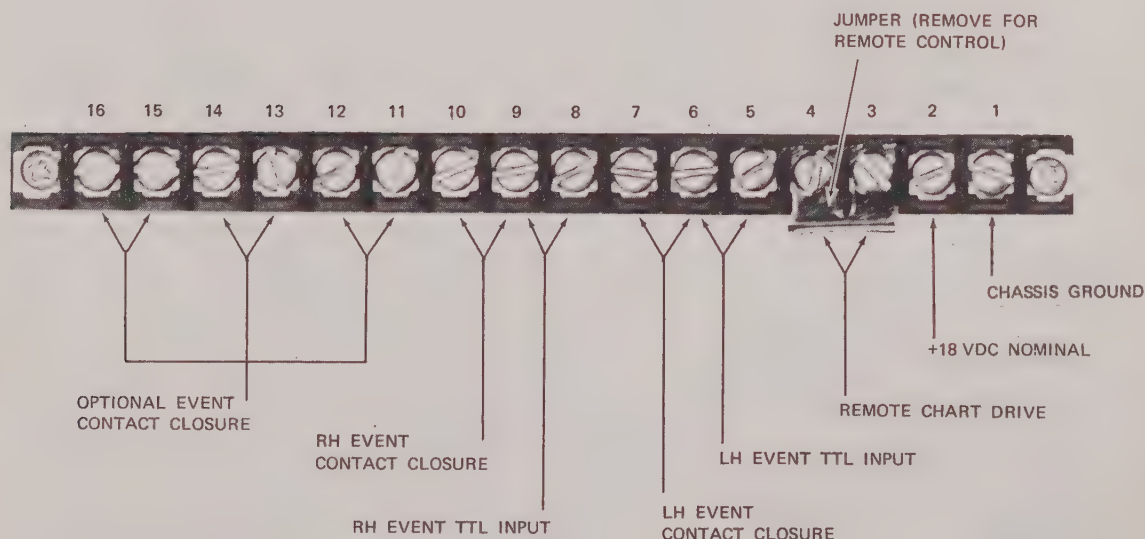
made by contact closure or TTL signal input. Refer to Figure 2-2 for connections.

**b. Optional Event Markers**

Interchannel optional event markers are actuated by a contact closure via the rear panel terminal strip. Refer to Figure 2-2 for connections.

**2.6 REMOTE CHART DRIVE (Stop/Start)**

For remote chart drive operation, remove jumper between pins 3 and 4 on rear panel terminal strip. A contact closure across these pins will remote enable chart drive motor. Refer to Figure 2-2. Chart SPEED must be preselected.



bi 1535

**FIGURE 2-2. REAR PANEL TERMINAL CONNECTIONS**



## 2.7 CHART TAKEUP INSTALLATION

Refer to Figure 2-3, and install the optional chart takeup as follows:

1. Disconnect recorder from power source.
2. Remove case from recorder as described in Section VI.
3. Remove plastic caps covering slots in front panel.
4. Position chart takeup on front panel with drive belt on left side. Secure with screws and lockwashers.

5. Slide pulley onto drive roll shaft, and secure with cotter pin.
6. Position drive belt over pulley.
7. Reinstall case.

## 2.8 RACK MOUNTING KITS

A list of rack mounting kits for all 2000 series recorders is found in Section I. Installation instructions are included with each kit.

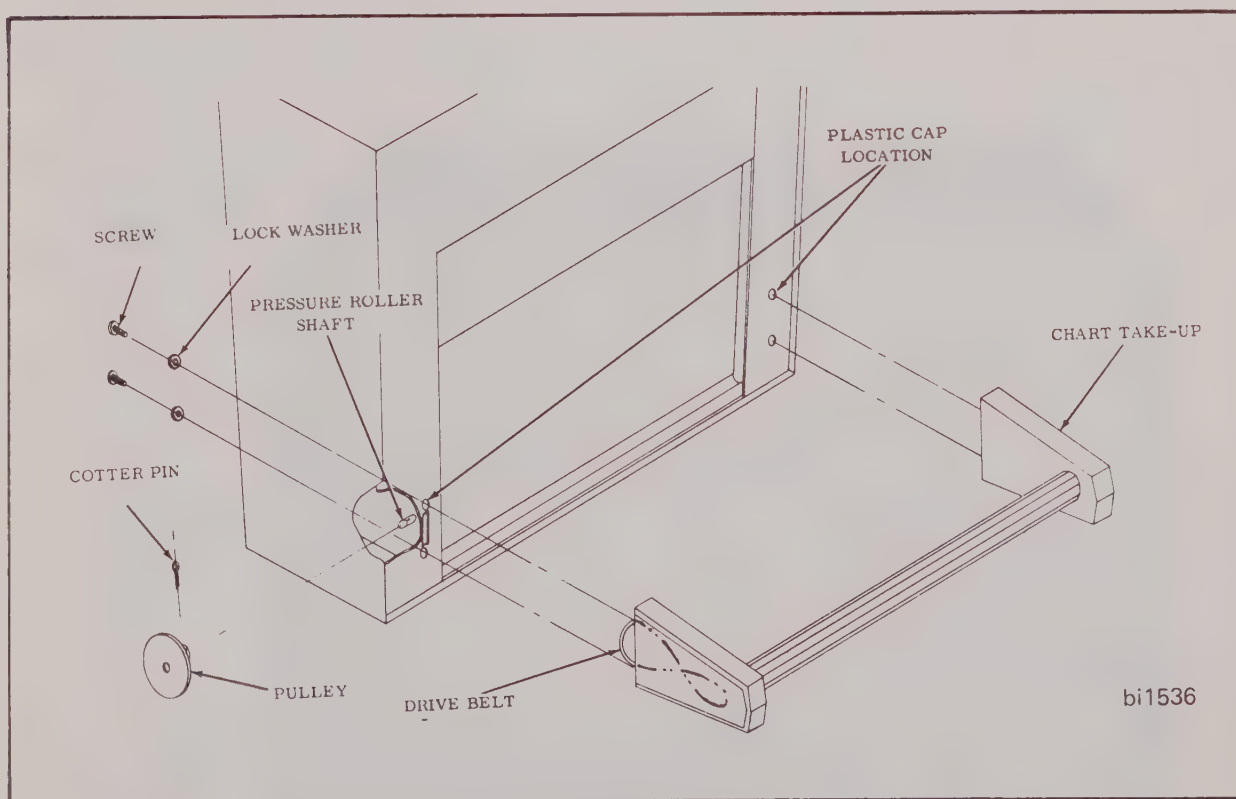


**FIGURE 2-3. CHART TAKEUP INSTALLATION**



## SECTION III

### OPERATION

#### 3.1 GENERAL

This section provides complete instructions for operation of the recorder. Functional descriptions of the controls and indicators are provided. If the recorder is equipped with preamplifiers, refer to their applicable instruction manuals for operating instructions.

#### 3.2 FRONT PANEL CONTROLS & INDICATORS

Figure 3-1 illustrates the front panel controls and indicators. The following list corresponds to the items called out on Figure 3-1.

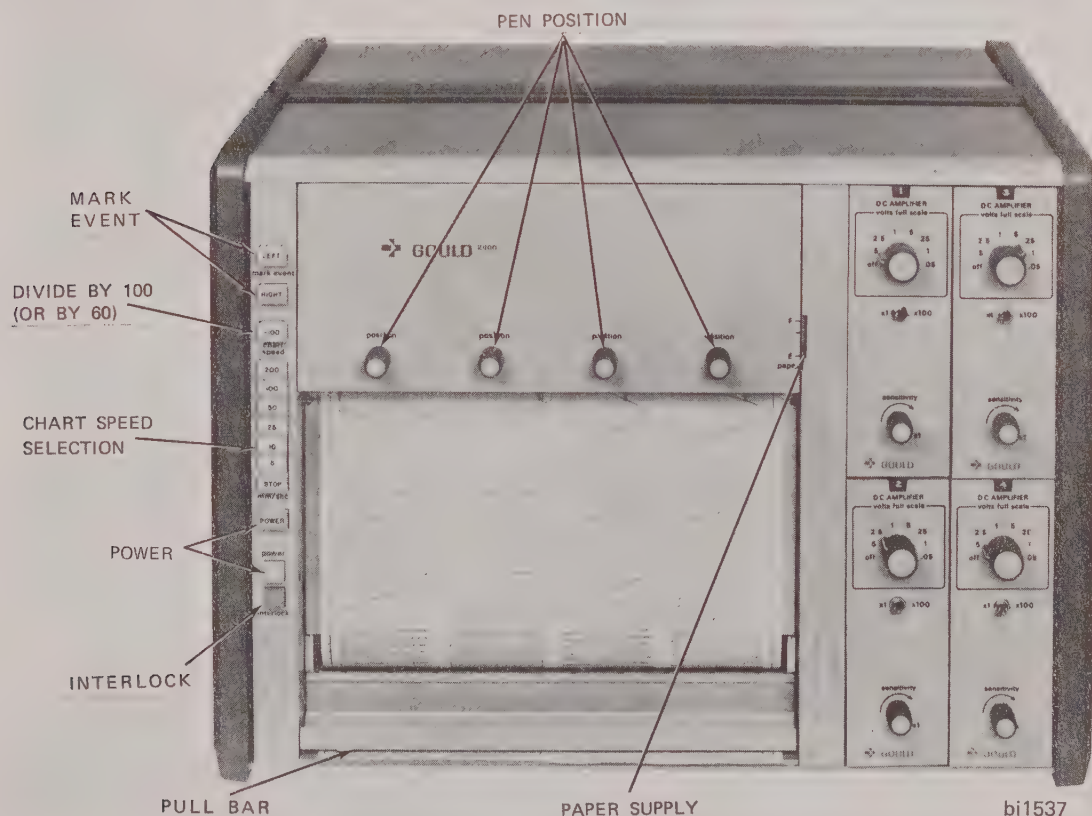


FIGURE 3-1. FRONT PANEL CONTROLS & INDICATORS (TYPICAL)



| CONTROLS                              | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                        |
|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| POWER . . . . .                       | Controls AC to recorder. Depress to turn recorder ON or OFF. POWER lamp illuminates when recorder is ON.                                                                                                                                                                                                                                                           |
| CHART SPEED . . . . .                 | Permits selection of six chart speeds and STOP. When in STOP position chart drive is off, and pens will not respond to input signals. Depressing any chart speed button will activate the chart drive at the selected speed. Chart speeds may be changed while chart drive is running.                                                                             |
| DIVIDE BY 100 . . . . .<br>(or by 60) | When depressed, chart speeds become 0.05, 0.10, 0.25, 0.50, 1.0, and 2.0 mm/sec (divide by 60 becomes 5, 10, 25, 50, 100, and 200 mm/min.                                                                                                                                                                                                                          |
| MARK EVENT . . . . .                  | Two momentary switches permit manual marking of an event. When left MARK EVENT button is depressed the left event marker pen will deflect to the left. When the right MARK EVENT button is depressed the right event marker pen will deflect to the left.<br><br><b>NOTE: The EVENT MARKER pens will remain deflected until the mark event button is released.</b> |
| POSITION . . . . .                    | Permits pen positioning anywhere within the channel.                                                                                                                                                                                                                                                                                                               |
| PULL BAR INDICATOR . . . . .          | Pull to gain access to chart paper supply roll.                                                                                                                                                                                                                                                                                                                    |
| INTERLOCK INDICATOR . . . . .         | Lamp illuminates when writing table is not completely closed or paper supply is exhausted.                                                                                                                                                                                                                                                                         |
| POWER . . . . .                       | Lamp illuminates when POWER switch is depressed.                                                                                                                                                                                                                                                                                                                   |
| PAPER SUPPLY INDICATOR . . . . .      | Gauge to indicate quantity of chart paper remaining.                                                                                                                                                                                                                                                                                                               |

### 3.3 REAR PANEL

Figure 3-2 illustrates the recorder rear panel. The following list corresponds to the figure.

| CONTROL                | DESCRIPTION                                        |
|------------------------|----------------------------------------------------|
| PREAMP CAGE . . . . .  | If equipped, houses preamplifiers.                 |
| SIGNAL INPUT . . . . . | Jacks for signal input direct to drive amplifiers. |



|                                     |                                                                                                            |
|-------------------------------------|------------------------------------------------------------------------------------------------------------|
| TERMINAL STRIP .....                | Refer to Section II for connections.                                                                       |
| TIMER .....                         | ON/OFF toggle switch for timed left hand event marker activation.                                          |
| ACCESSORY OUTLET .....              | Provides ac power for other equipment.                                                                     |
| CARTRIDGE ON/OFF .....              | Turns ink supply ON or OFF.                                                                                |
| DRIVE AMPLIFIER MONITOR JACKS ..... | Monitors output of preamplifier (regardless of chart display). For use on Scope, Meter, Output panel, etc. |

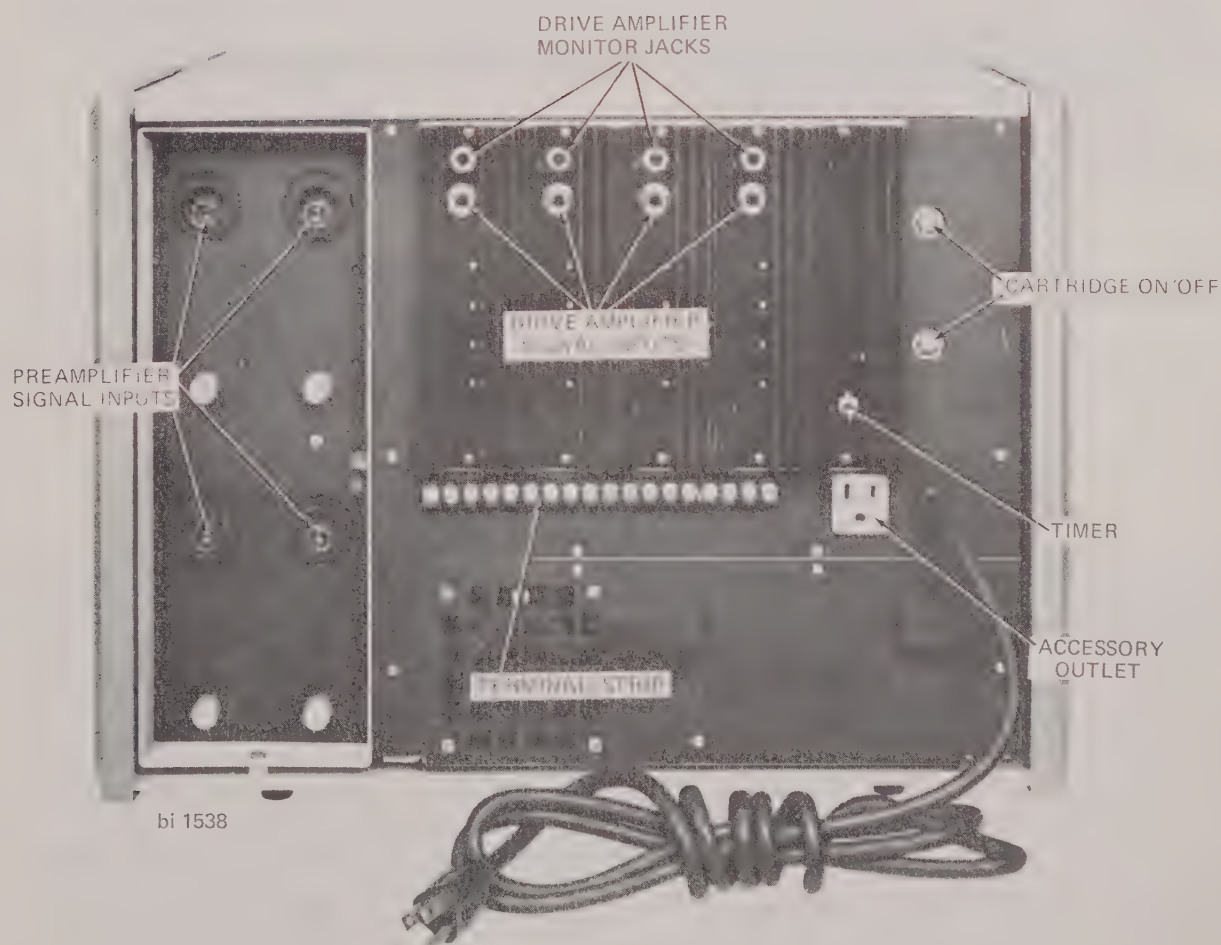


FIGURE 3-2 REAR PANEL



### 3.4 TIMER SETTING

The timer actuates left event markers at programmed repetition rates. Selection of repetition rates is made via switch S-104 on the control board. Set rate as follows:

1. Turn recorder power OFF.
2. Loosen the two screws which secure the control board and pull out of the recorder.
3. Set switch positions for desired repetition rate per Table 3-1.

**NOTE:** Use switch positions for line frequency recorder operates on.

4. Replace control board and secure with screws.
5. Turn recorder power ON.
6. Turn TIMER switch ON. Timer ready for operation.

### 3.5 SETUP AND OPERATION

Prepare recorder for operation as follows:

**CAUTION:** MAKE SURE ALL PROCEDURES DESCRIBED IN SECTION II, INSTALLATION HAVE BEEN PERFORMED.

1. Check paper supply level. Make sure an adequate supply present for length of time recorder is to be operated and it is properly threaded.
2. Make sure chart STOP pushbutton is depressed.
3. Depress POWER pushbutton. POWER lamp should illuminate.
4. Depress 5mm/sec chart speed pushbutton, and allow chart to travel about one foot. If no pen trace is present, refer to Section VI.
5. Set pen to show full scale deflection within channel limits.
6. Apply input signal to recorder.
7. Set chart SPEED to that which will best display signal.

**TABLE 3-1. SWITCH SETTINGS VS TIMER REPETITION RATE  
FOR VARIOUS POWER LINE FREQUENCIES**

| REPETITION<br>RATE | 60 HZ LINE |           | 50 HZ LINE |           | 400 HZ LINE |             |
|--------------------|------------|-----------|------------|-----------|-------------|-------------|
|                    | SW ON      | SW OFF    | SW ON      | SW OFF    | SW ON       | SW OFF      |
| 0.1 SECOND         | 2,3,5      | 1,4,6,7,8 | 1,3,5      | 2,4,6,7,8 | 3,6         | 1,2,4,5,7,8 |
| 1.0 SECOND         | 2,3,6      | 1,4,5,7,8 | 1,3,6      | 2,4,5,7,8 | 3,7         | 1,2,4,5,6,8 |
| 10.0 SECONDS       | 2,3,7      | 1,4,5,6,8 | 1,3,7      | 2,4,5,6,8 | 3,8         | 1,2,4,5,6,7 |
| 100.0 SECONDS      | 2,3,8      | 1,4,5,6,7 | 1,3,8      | 2,4,5,6,7 | —           | —           |
| 0.01 MINUTE        | 2,4,6      | 1,3,5,7,8 | 1,4,6      | 2,3,5,7,8 | 4,7         | 1,2,3,5,6,8 |
| 0.10 MINUTE        | 2,4,7      | 1,3,5,6,8 | 1,4,7      | 2,3,5,6,8 | 4,8         | 1,2,3,5,6,7 |
| 1.00 MINUTE        | 2,4,8      | 1,3,5,6,7 | 1,4,8      | 2,3,5,6,7 | —           | —           |



## SECTION IV

### THEORY OF OPERATION

#### 4.1 GENERAL

The 2000 Series Recorder is a modular-constructed unit consisting of a mainframe and analog recording channels. One of three mainframe sizes is used depending upon the number of analog recording channels incorporated. Each mainframe is identical except for its physical size. Each analog recording channel is electrically identical. Figure 4-1 illustrates a block diagram of the basic recorder.

Preamplifiers are optional and are discussed in their respective instruction manuals.

#### 4.2 MAINFRAME

The mainframe contains a switchboard, control board, control transformer, chart drive motor and transmission and event markers.

##### a. Switchboard

The switchboard is mounted on the left side of the front panel. It contains the operator controls:

switches for POWER ON/OFF, CHART SPEED selection, and EVENT marker actuation; and indicators for POWER ON and INTERLOCK.

The POWER switch is a set-reset pushbutton which interrupts both phase and neutral sides of the ac power line.

Chart speed selection is made by depressing one of six SPEED, a DIVIDE, or STOP pushbutton. The SPEED and STOP pushbuttons are mechanically interlocked to reset a previously selected pushbutton. The DIVIDE is a set/reset pushbutton. A combination of three transmission solenoids are activated by the SPEED pushbuttons to obtain the desired chart speed. Table 4-1 defines chart speed versus solenoid activation. Each chart speed may be divided by 60 or 100 (depending upon model number) by depressing the DIVIDE pushbutton. This activates solenoid L101. The STOP pushbutton interrupts power to the motor/transmission via relay K-101 and resets the SPEED pushbuttons.

When the LEFT or RIGHT MARK EVENT pushbuttons are depressed, solenoids L108 and

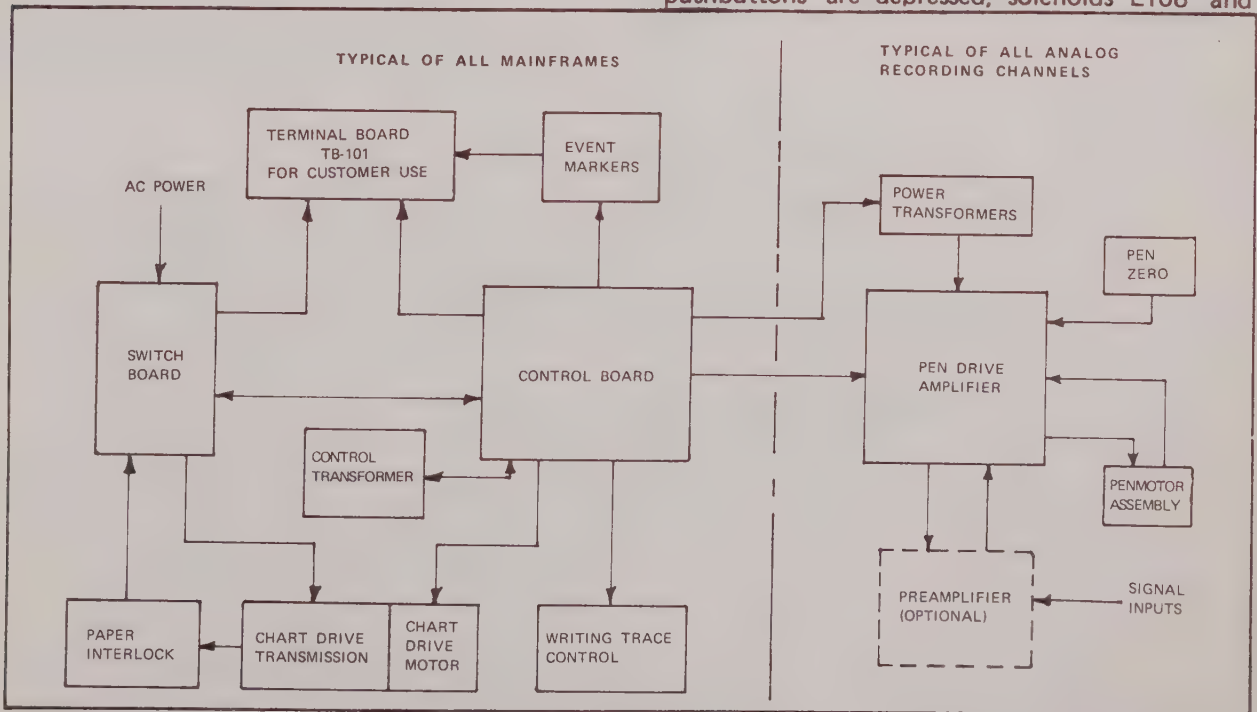


FIGURE 4-1. BASIC RECORDER BLOCK DIAGRAM



L 109 respectively are energized activating the left or right event markers. These are momentary pushbuttons, and reset when released.

**TABLE 4-1.**  
**CHART SPEEDS VS SOLENOID ACTIVATION**

| CHART SPEED<br>(MM/SEC) | SOLENOID ACTIVATED |       |       |
|-------------------------|--------------------|-------|-------|
|                         | L-102              | L-103 | L-104 |
| 5.0                     | x                  | x     |       |
| 10                      | x                  |       | x     |
| 25                      |                    | x     | x     |
| 50                      |                    | x     |       |
| 100                     |                    |       | x     |
| 200                     |                    |       |       |

#### b. Control Board

The control board is mounted in the card cage in the rear of the recorder. Contained in the control board are the branch fuses, start/stop relay K-101, the +5Vdc and +28Vdc power supplies, and timer.

Fuses are provided to protect each power branch. Table 4-2 shows fuse and circuit protected.

DPDT relay K 101 controls power to the chart drive motor, ink solenoids, standard event markers, and optical couplers located in the pen drive amplifiers. It is energized when the chart STOP pushbutton is released. When energized, one set of contacts supplies power to the chart drive motor thru fuse F112 and activates the ink manifold solenoids. When de-energized, the other set of contacts inhibit the event markers and optical couplers in the pen drive amplifiers.

The control board contains two dc power supplies: +28V and +5V. The +28Vdc power source is obtained from bridge rectifier CR102 and control transformer T109. The unfiltered section of this section of the supply provides power to relay K101, optional event marker solenoids, and the indicator lamps. The filtered section of this supply provides power to the standard event markers to insure accuracy when precise time events are required. The +5Vdc power source is obtained thru CR102 from a second winding on control transformer T109. This supply is filtered and regulated to provide power for the pen drive amplifier optical couplers and timer.

Pulsating dc voltage is provided from bridge rectifier CR101 to operate the ink supply solenoids.

**TABLE 4-2. FUSE VS CIRCUIT PROTECTED**

| FUSE               | CIRCUIT PROTECTED                                                                                                              |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------|
| F101<br>To<br>F108 | Analog channel power transformers T 101 to T 108. Fuses and transformers supplied according to number of channels in recorder. |
| F109               | Control transformer T 109 which supplies power for the +5V and +28V dc power supplies.                                         |
| F110               | Fan motor B-102 on the 250 mm and 380 mm models.                                                                               |
| F111               | Ink solenoids                                                                                                                  |
| F112               | Chart Drive Motor                                                                                                              |
| F113               | 115Vac convenience outlet.                                                                                                     |



The timer operates as a function of ac line frequency. Optical coupler U107 shapes the sinusoidal wave into a square wave. Binary counters U102 through U105 count the square wave pulses. Switch S104 selects combinations of U102 through U105 for the output pulse repetition rate (time interval) desired. The output pulse drives monostable multivibrator U106. Output from U106 turns on Q101 or Q102, activating the left event markers. (See Table 3-1).

#### c. Event Markers

Left and right standard event markers are activated by the MARK EVENT switches, optional timer, or remote application of TTL signals or contact closure. Depressing a MARK EVENT switch permits current to flow from CR106 through the mark event solenoid, activating the event marker.

**NOTE:** TTL and switch closure are described for left event marker only. Right event marker is identical.

Placing a switch closure (short) across terminals 6 and 7 of TB101, permits current to flow from CR106 through the mark event solenoid, activating the event marker. Application of a TTL signal across terminals 5 and 6 of TB101, causes Q101 to conduct, activating the event marker.

### 4.3 ANALOG RECORDING CHANNELS

#### a. General

Each analog recording channel consists of a power transformer, pen drive amplifier, and penmotor. The channels are isolated from one another by using separate transformer power supplies and optical couplers. The optical coupler disables the pen drive amplifier whenever relay K101 on the control board is de-energized from depressing chart STOP pushbutton or upon loss of ac power.

Each power transformer has two primary and three secondary windings. The primary windings can be wired in parallel for 115vac operation or in series for 230 vac operation. Two of the secondary windings ( $\pm 35$  and  $\pm 15$  volts) provide power for the pen drive amplifier. The third (13Vac) may be used in preamplifiers requiring isolated power supplies for bridge excitation or suppression.

Figure 4-2 shows a block diagram of an analog channel. The penmotor drive amplifier is a complete servo system and uses a linear voltage displacement transformer (Metrisite\*) in the penmotor to develop position, and a velocity transducer for velocity. These signals are summed with the input signal in a dc error amplifier which, after amplification, drives the penmotor.

#### b. Signal Limiter

The input signal enters the signal limiter and is summed with the pen zero signal. The summed signal is fed to a diode bridge circuit. Output from the bridge is limited to  $\pm 2.6$  volts.

#### c. Frequency Compensation Network

Output from the signal limiter is fed to a frequency compensation network. Here, the signal's frequency response is adjusted to be flat within 2% from DC to 30Hz for 100 mm pen deflection and from dc to 50 Hz for 50 mm pen deflection. The circuit also provides a gain change to allow use with either 50 or 100 mm penmotors. The frequency compensated signal is then fed to summing network where it is combined with error and velocity signals.

#### d. Oscillator and Demodulator

Position feedback is obtained from the Metrisite. Excitation for the Metrisite is obtained from a 20 KHz Wein Bridge Oscillator. A demodulator attenuates the 20KHz carrier. Output from the demodulator is the position feedback signal.

#### e. Servo Control Amplifier

The compensated input signal, position feedback, and velocity are summed at the input of the servo amplifier. The output of this stage drives a Class B amplifier, which drives the pen to the proper position on the chart. This occurs when the summed signal is reduced to zero.

\* Registered Trademark of Gould Inc.



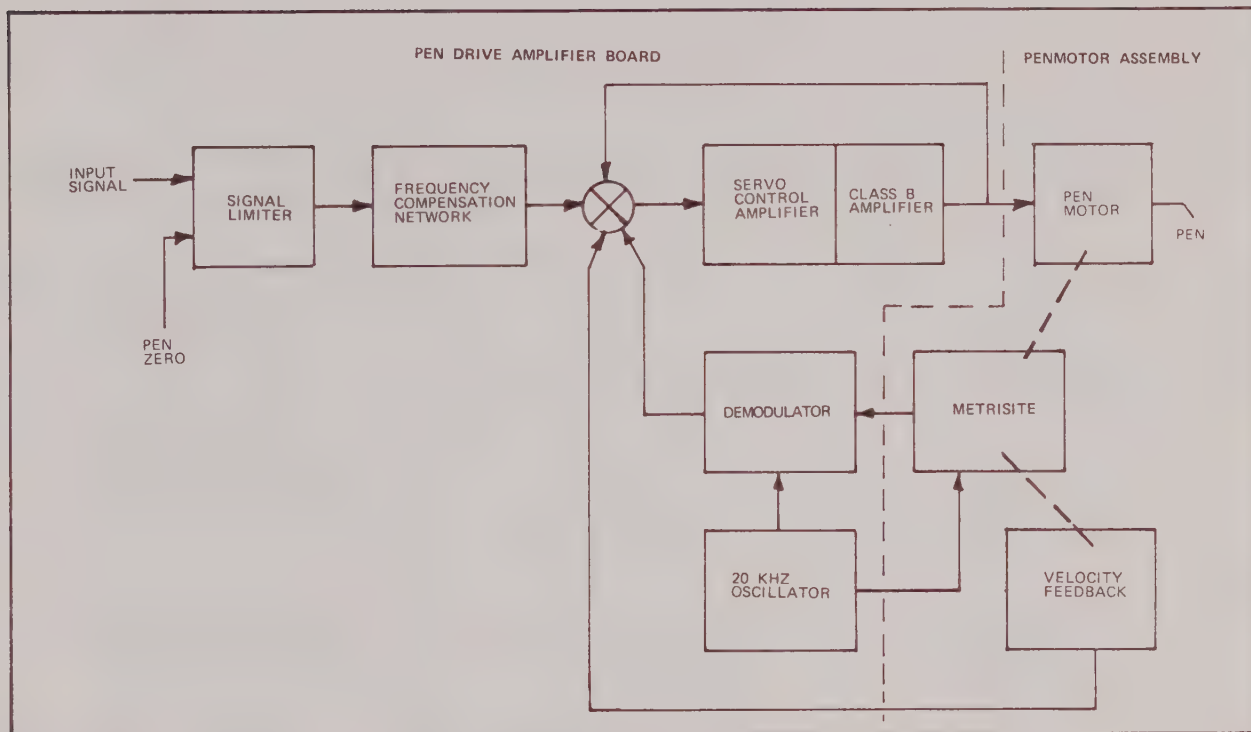


FIGURE 4.2. ANALOG CHANNEL BLOCK DIAGRAM



## SECTION V

### TROUBLESHOOTING

#### 5.1 GENERAL

This section provides troubleshooting hints to assist the operator and/or serviceman in locating malfunctions that are the possible causes and remedy. If a problem exists which is not identified in this section, contact the factory for assistance.

#### 5.2 ELECTRICAL POWER MALFUNCTIONS

| MALFUNCTION                                                                                             | CAUSE                                                                                              | REMEDY                                                                |
|---------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| 1. Recorder inoperative (Power ON and INTER-LOCK Lamps are extinguished with POWER ON switch depressed. | a. Recorder not connected to power source.<br>b. Fuse F109 blown.<br>c. POWER ON switch defective. | a. Connect to power source.<br>b. Replace fuse.<br>c. Replace switch. |
| 2. Recorder Inoperative (POWER ON and INTER-LOCK Lamps are illuminated.                                 | a. Chart Paper torn or supply is depleted.<br>b. INTERLOCK switch defective.                       | a. Rethread or replace chart paper.<br>b. Replace switch.             |

#### 5.3 CHART DRIVE MALFUNCTIONS

| MALFUNCTION                       | CAUSE                                                                                                                                                                                                                                                  | REMEDY                                                                                                                                                                                |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Inoperative                    | a. Desired Chart SPEED button not depressed.<br>b. Drive belt worn or broken.<br>c. Jumper between pins 3 & 4 of TB101 missing.<br>d. Fuses F111 or F112 blown.<br>e. Motor defective.<br>f. Chart speed switch defective.<br>g. Relay K101 defective. | a. Depress desired chart speed button.<br>b. Replace drive belt.<br>c. Replace Jumper.<br>d. Replace Fuse.<br>e. Replace motor.<br>f. Replace switch board assy.<br>g. Replace relay. |
| 2. Operative on only some speeds. | a. Chart speed switches defective.<br>b. Transmission defective<br>c. Broken wire on transmission terminal.                                                                                                                                            | a. Replace switch board assy.<br>b. Replace transmission.<br>c. Repair connection.                                                                                                    |



## 5.3 CHART DRIVE MALFUNCTIONS (continued)

| MALFUNCTION                                | CAUSE                                                                                | REMEDY                                                             |
|--------------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------|
| 3. Inoperative on divide by 100 speed.     | a. Transmission defective<br>b. Switch defective.<br>c. Broken wire to transmission. | a. Replace transmission.<br>b. Replace switch.<br>c. Replace wire. |
| 4. Chart speed not accurate or is erratic. | a. Drive roll worn excessively.<br>b. Transmission defective                         | a. Clean or replace drive roll.<br>b. Replace transmission.        |

## 5.4 WRITING SYSTEM MALFUNCTIONS

| MALFUNCTION                                        | CAUSE                                                                                                                                                                                                                                                         | REMEDY                                                                                                                                                                                                             |
|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Trace missing or faint.                         | a. Ink supply exhausted.<br>b. Screw on ink cartridge not fully counterclockwise.<br>c. Ink manifold valves not in full ON position.<br>d. Pens clogged.<br>e. Ink manifold solenoid defective.<br>f. Ink manifold solenoid de-energized.<br>g. Air in System | a. Replace ink cartridge.<br>b. Turn screw fully counterclockwise.<br>c. Rotate to full ON position.<br>d. Clean or replace pens.<br>e. Replace solenoid.<br>f. Fuse F112 blown: replace fuse.<br>g. Bleed System. |
| 2. Trace heavy or wet; pen gouges paper.           | a. Pen excessively worn.<br>b. Pen not properly lapped<br>c. Improper pen pressure.                                                                                                                                                                           | a. Replace pen.<br>b. Lap pen.<br>c. Adjust pen pressure.                                                                                                                                                          |
| 3. All pens not on same time line.                 | a. Pen (s) out of alignment.                                                                                                                                                                                                                                  | a. Align Pen (s).                                                                                                                                                                                                  |
| 4. Pen fails to return to same position each time. | a. Loose pen.<br>b. Loose penmotor linkage.                                                                                                                                                                                                                   | a. Align and tighten pen.<br>b. Replace penmotor.                                                                                                                                                                  |



## 5.5 SIGNAL MALFUNCTIONS

| MALFUNCTION                                                                    | CAUSE                                            | REMEDY                                                                                                      |
|--------------------------------------------------------------------------------|--------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| 1. Trace unusually wide.                                                       | a. Noise appearing at the pen tip.               | a. Check input signal and connections. Defective drive amplifier or preamplifier boards; repair or replace. |
| 2. No signal on any or all channels.                                           | a. Drive amplifier or preamplifier defective.    | a. Replace drive amplifier or preamplifier.                                                                 |
|                                                                                | b. Drive amp fuse (s) blown.                     | b. Replace fuse (s) after correcting malfunction.                                                           |
|                                                                                | c. Chart speed stop switch defective.            | c. Replace switch.                                                                                          |
| 3. Pens limp or biased to either side.                                         | a. Drive amplifier or preamplifier defective.    | a. Repair or replace drive amplifier or preamplifier                                                        |
|                                                                                | b. Recorder requires calibration.                | b. Calibrate recorder.                                                                                      |
|                                                                                | c. Pen loose.                                    | c. Align and tighten pen.                                                                                   |
|                                                                                | d. Defective pen position pot.                   | d. Replace pen position pot.                                                                                |
| 4. Trace not in sync with time divisions on chart, or time pulses are erratic. | a. Excessive line noise may be creating problem. | a. Place "Transzorb" in power line (Gould P/N 290138-1).<br>NOTE: Low Frequency noises will be absorbed.    |
|                                                                                |                                                  | b. Operate recorder on separate power source.                                                               |



## SECTION VI

### MAINTENANCE

#### 6.1 GENERAL

This section contains information for use in preventive and corrective maintenance of the 2000 Series Recorder. Refer to Section V, Troubleshooting for guidelines in localizing problem areas.

#### 6.2 CLEANING

##### a. General Cleaning

**CAUTION: AVOID USE OF CHEMICAL CLEANING AGENTS WHICH MIGHT DAMAGE PLASTIC OR PAINTED SURFACES. DO NOT USE CHEMICAL WHICH CONTAIN TOLUENE, ACETONE, OR SIMILAR SOLVENTS.**

**EXTERIOR:** Remove loose dust with a soft cloth or small paint brush. Dirt which remains can be removed with a soft cloth dampened in a mild detergent and water solution. Do not use abrasive cleaners.

**INTERIOR:** Dust in recorder interior should be removed occasionally due to its electrical conductivity under high-humidity conditions. Blow off accumulated dust with dry, low-pressure air. Remove any dirt which remains with a soft paint brush or a soft cloth dampened in a mild detergent and water solution. A cotton-tipped applicator is useful for cleaning in narrow spaces and/or printed circuit boards.

##### b. Ink Removal

**NOTE:** The recommended ink remover is ANCHOR HAND CREAM, No. 25 obtainable from Anchor Office Supply Co. of Cleveland, Ohio.

1. Blot up any excess ink with a tissue or paper towel.
2. Apply ink remover to the inked area ONLY. DO NOT attempt a general cleaning.
3. Gently rub the area with a soft cloth until the ink spot is removed.

4. Wipe the area thoroughly with a damp cloth.
5. Allow cleaned area to dry at least ten minutes before using recorder.

#### 6.3 CHART PAPER REPLACEMENT

1. Depress chart STOP pushbutton and release power pushbutton.
2. Grasp pull bar (Figure 6-1) and open writing table.

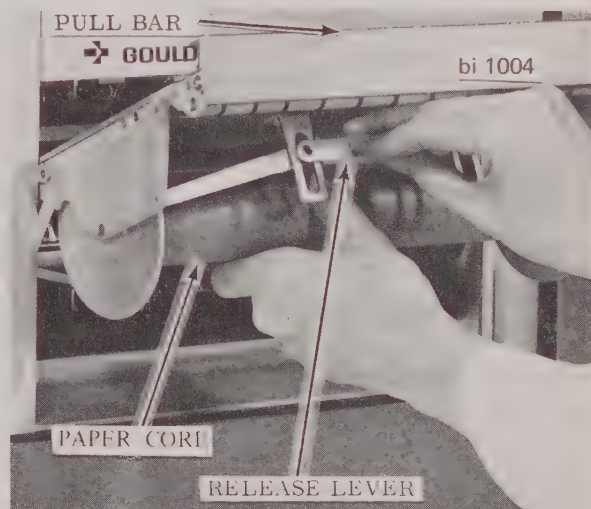


FIGURE 6-1. PAPER ROLL REMOVAL

3. Hold paper supply roll and pull down on paper supply release lever. Remove paper supply roll.
4. Unscrew right flange from paper supply roll. Remove and discard core (Figure 6-2).
5. Slide new paper roll onto supply shaft. Make sure notches in paper core align with guide pins on left flange and paper edge is facing forward and down.
6. Screw right flange onto supply shaft until it is snug against paper edge.
7. Insert paper roll into writing table assembly. Push release lever up to lock into position.



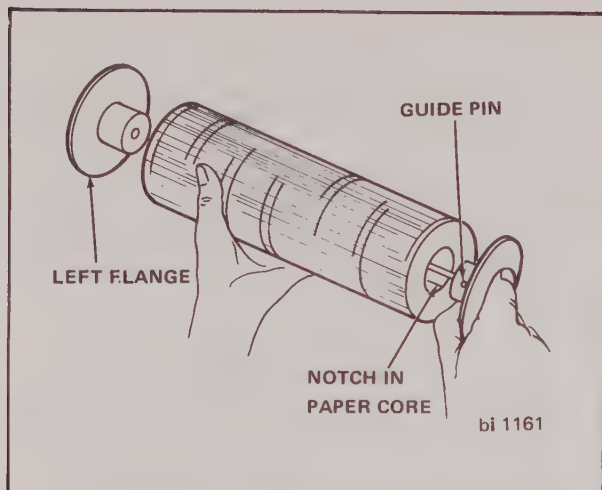


FIGURE 6-2. CHANGING CHART PAPER

**CAUTION:** MAKE SURE SHAFT IS SEATED PROPERLY AND ROTATES FREELY. USE CARE WHEN THREADING PAPER SO NOT TO DAMAGE PENS.

8. Refer to Figure 6-3. Feed paper over writing bar, down through slot between pull bar and drive roll, around pressure roll, and out to front of writing table assembly.
9. Slowly close writing table while gently pulling on chart paper. When friction resists rotation of paper roll, pull paper taut and center, and close writing table assembly. Make sure table is completely closed.
10. Turn recorder on and run out about two feet of chart paper at 100 mm/sec to align on writing table.

## 6.4 INK CARTRIDGE REPLACEMENT

Ink supply should be sufficient for one year under normal conditions. Cartridge(s) are located in rear of recorder. Follow procedure below to replace:

**WARNING:** MAKE SURE POWER IS OFF AND RECORDER IS DISCONNECTED FROM POWER SOURCE.

1. Loosen two screws and pull control board assembly and first drive amplifier board assembly from rear of recorder. Remove top rear cover by sliding it back and lifting out. Refer to Figure 6-4.

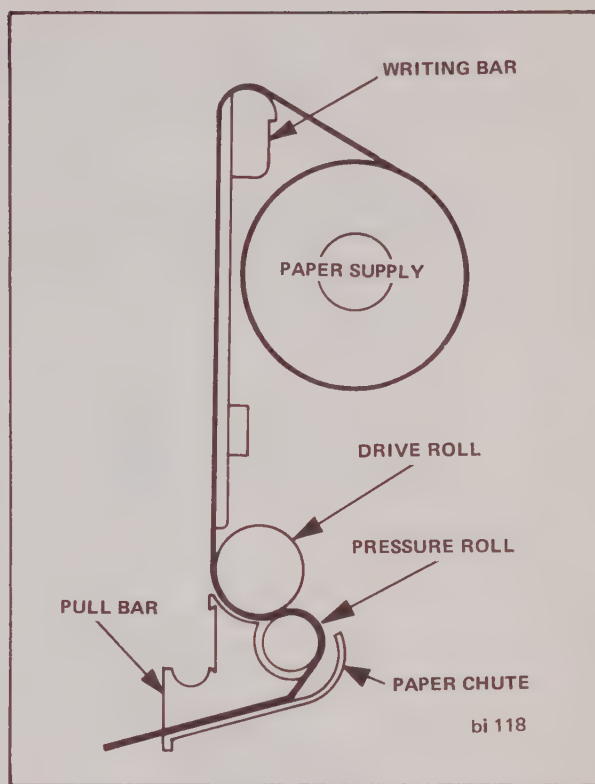


FIGURE 6-3. PAPER THREADING DIAGRAM

2. Turn activating screw clockwise until compression spring in ink plunger assembly is drawn up tight.

**CAUTION:** DO NOT PERMIT INK TO SPILL ON RECORDER COMPONENTS. PLACE PAPER TOWELS UNDER INK SYSTEM.

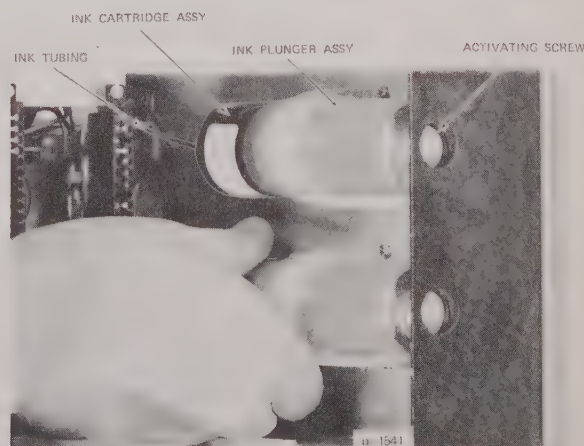


FIGURE 6-4. INK CARTRIDGE REPLACEMENT



3. Carefully pull ink tubing off of ink cartridge.

**CAUTION: DO NOT USE TOOLS WHICH MAY GOUGE OR CUT THE INK TUBING.**

4. Unscrew ink cartridge from plunger assembly and discard. Refer to Figure 6-5.

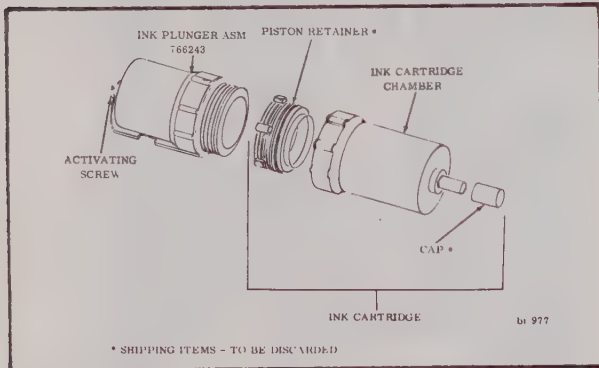


**FIGURE 6-5. INK CARTRIDGE ASSEMBLY**

5. Remove piston retainer from replacement cartridge and discard.
6. Install cartridge in plunger assembly and tighten firmly.
7. Remove shipping cap from ink cartridge and discard.
8. Install ink tube on ink cartridge.
9. Turn activating screw counterclockwise until snug to pressurize ink system. Check for leaks.
10. Replace control and drive amp boards and top rear cover.

**NOTE:** Access to ink cartridge on 2200 series recorders is thru rectangular hole on left plate. Recorder assembly must be removed from case. Procedure for cartridge replacement is the same.

## 6.5 PEN PRESSURE ADJUSTMENT

Analog or event marker pen pressure should be checked if trace is excessively wide (low pen pressure) or pen gouges chart paper (high pen pressure). A gram gauge (Gould part number 240601-910) is used to measure both analog and event marker pen pressure. Both analog and event marker pens are measured in the same way. Measure pen pressure as follows:

1. Raise pen access cover by pulling out on bottom and sliding back into recorder.
2. Turn ON recorder and set chart SPEED at 5 mm/sec.
3. Place gram gage hook under pen as close as possible to tip. Form a right angle to pen shaft with hook (Figure 6-6).

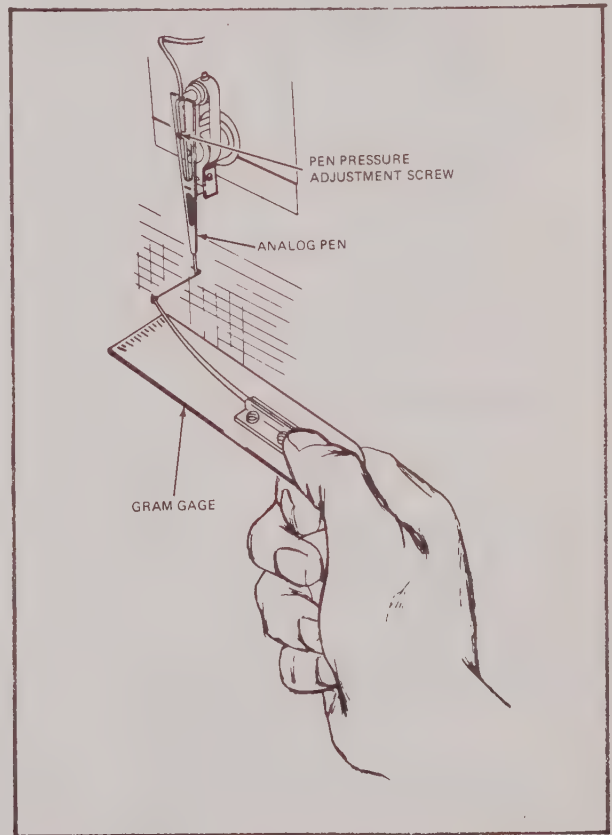


**FIGURE 6-6. PEN PRESSURE MEASUREMENT**

4. Slowly pull pen from chart paper. Read gage the moment excessive ink starts flowing from pen tip. Proper pressure for analog pens is  $30 \pm 2$  grams, for event marker pens  $25 \pm 2$  grams.
5. If pen pressure is not within specified limits, adjust pressure using special pen adjustment wrench (Gould part number 1-120922-18). Refer to Figure 6-7. Turn screw clockwise to increase pressure, counterclockwise to decrease pressure.
6. Recheck pen pressure per steps 3 and 4.



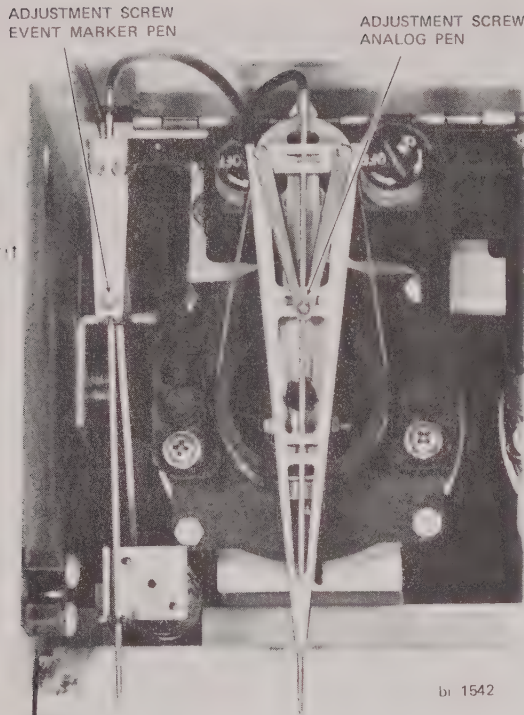


FIGURE 6-7. PEN PRESSURE ADJUSTMENT

## 6.6 PEN LAPPING

### a. General

This paragraph describes and illustrates the proper procedures for lapping the analog and event pens. Intermittent or "wet" ink trace are indications that pen pressure is incorrect or that pen requires lapping. Check for "wet" writing by operating the recorder (no signal applied). Check pen trace by wiping index finger, with moderate pressure, across trace approximately one inch below pen tip. If ink does not smear, pen is properly lapped. If trace smears, check and adjust pen pressure (Para. 6.5). Repeat test, and if trace continues to smear, lapping is required.

### b. Lapping Procedures

**CAUTION: LAPPING SHOULD ONLY BE DONE WHEN ABSOLUTELY NECESSARY. EXCESSIVE LAPPING WILL SHORTEN PEN LIFE.**

1. Turn OFF recorder.
2. Raise pen access cover by pulling out on

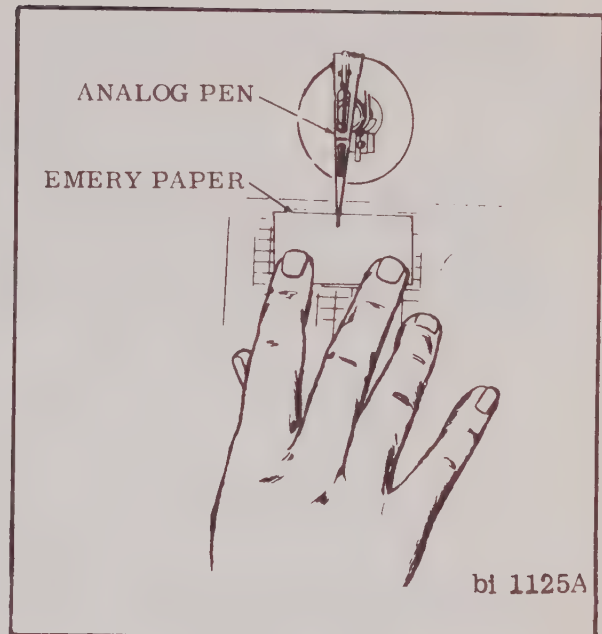


FIGURE 6-8. PEN LAPPING

bottom and sliding it back into recorder.

3. Carefully raise pen tip just enough to slide a small strip of emery paper (600A, Gould part number 669234) under pen tip.
4. Refer to Figure 6-8. Hold emery paper flat against writing table and move it in a circular motion several times while gently pressing pen tip with finger.
5. Remove emery paper and clean debris from pen tip. Operate recorder at 5 mm/sec chart SPEED.
6. Check pen trace by wiping index finger, with moderate pressure, across trace about one inch below pen tip. If ink does not smear, pen is properly lapped. If ink smears, check pen pressure per paragraph 6.5.
7. Repeat lapping procedure if necessary.
8. If pen tip should become blocked during lapping operation, touch pen at top of pen (above tip) with a hot soldering iron for a few seconds with the pen tip raised slightly off the paper. This will usually start ink flowing and flush out abrasive.



9. When dry trace is achieved, turn recorder off.

## 6.7 PEN REPLACEMENT

Pens should only be replaced when excessively worn or broken. Replacement should be performed only by personnel who are familiar with the recorder. Replace and adjust one pen at a time.

### a. Analog Pen

1. Press chart speed STOP button and release POWER button.
2. Raise pen access cover by pulling out on bottom and sliding back into recorder.
3. Turn pen ink valve OFF with a flat-blade screwdriver. Refer to Figure 6-9.

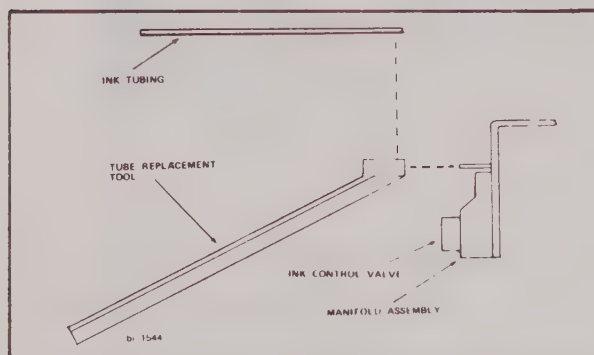


FIGURE 6-9. INK TUBE REMOVAL

4. Carefully remove ink tube from manifold and pen. Wipe off excess ink.

**CAUTION: DO NOT PERMIT INK TO SPILL ON RECORDER COMPONENTS. PLACE PAPER TOWELS AROUND AREA.**

5. Loosen two screws which secure pen to drive arm and carefully slide pen off (Figure 6-10).
6. Carefully slide new pen onto drive arm. Snug the two screws to secure pen.
7. Install new tubing between manifold and pen.
8. Turn ON ink valve.
9. Turn recorder ON and run at a chart speed of 5 mm/sec.

10. Carefully lift pen slightly and allow ink to bleed through pen tip.

11. Shut down recorder.

12. Gently grasp pen near hub and move pen across entire channel. If trace is not parallel to a horizontal line and/or pen is not on same line as other pens, turn pen in screw slots and slide pen vertically. Tighten screws.

13. Lap and set pen pressure per paragraphs 6.5 and 6.6.

### b. Event Marker Pen

1. Press chart speed STOP button and release POWER button.
2. Raise pen access cover by pulling out on bottom and sliding back into recorder.
3. Turn pen ink valve OFF with a flat blade screwdriver. Refer to Figure 6-9.
4. Carefully remove ink tube from pen and manifold.
5. Loosen adjustment screw and two screws which secure pen to arm, and carefully slide pen off. Refer to Figure 6-10.
6. Carefully slide new pen onto arm. Snug screws to secure pen. (Pen should be perpendicular to writing surface).
7. Install new tubing between manifold and pen.
8. Turn ON ink valve.
9. Turn recorder ON and run at a chart speed of 5 mm/sec. Adjust pen ZERO to set pen on event gridline.
10. Carefully lift pen slightly and allow ink to bleed through pen tip.
11. Shut down recorder.
12. If pen tip is not on same line as other pens, loosen screws and slide pen vertically. Tighten screws.
13. Lap and set pen pressure per paragraphs 6.5 and 6.6.



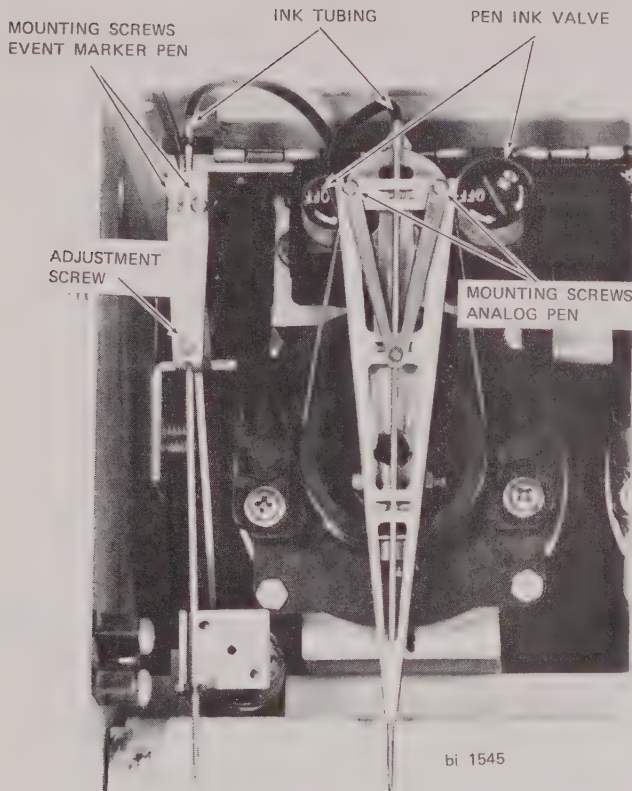


FIGURE 6-10. PEN REPLACEMENT

### 6.8 PEN CLEANING

Intermittent, missing, or faint traces may be indications of a clogged pen. The following cleaning procedure is intended as a guide, but may not always prove effective.

1. Turn recorder OFF.
2. Close ink valve on affected channel.
3. Remove ink tubing from manifold (Fig.6-9).
4. Remove pen (Para, 6.7a or 6.7b).

**NOTE:** Do not remove tubing from pen unless tubing is kinked or suspected of being defective.

5. Modify No. 18 hypodermic needle per Figure 6-11.

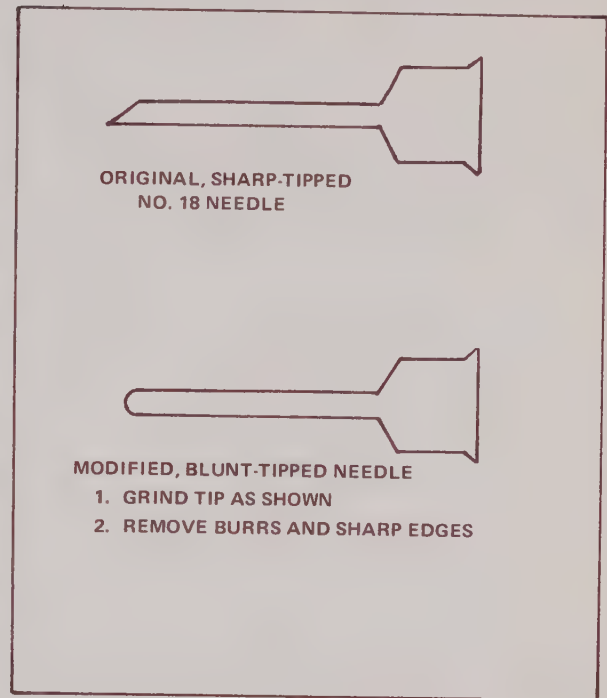


FIGURE 6-11. HYPODERMIC NEEDLE MODIFICATION

6. Attach modified needle onto 2cc hypodermic syringe.
  7. With syringe plunger depressed, insert needle in pen tubing.
  8. Immerse pen tip in cleaning agent (Isopropyl Alcohol, Cell-O-Solve or equivalent).
  9. Back-flush by slowly withdrawing syringe plunger.
- NOTE:** If may be necessary to allow the pen to remain for a brief period in the cleaning agent to dissolve dried ink at pen tip.
10. Install pen (para. 6.7a or 6.7b).



## 6.9 CASE REMOVAL

When removing the case, be careful not to damage gears or switchboard.

1. Remove four large machine screws from bottom of case.
2. If recorder is equipped with preamplifiers, remove channel 2 preamplifier, slide hand into preamp cage, and unplug connector. Pull from connector body, not from harness.
3. Slide recorder out from front of case. Push from rear and/or pull from side plates. Do not pull from top front of recorder.

## 6.10 DRIVE ASSEMBLY REPLACEMENT

**NOTE:** Refer to illustrated parts breakdowns of Recorder Assembly, L.H. Plate Assembly, Chassis Assembly, and Drive Assembly in Section VIII.

Remove the drive assembly as follows:

1. Remove case per paragraph 6.9.
2. Remove rear cover assembly (item 27) from recorder assembly.
3. Remove blue wire from TB102-2, green/orange wire from TB102-5 and black wire from TB102-6. TB102 is located on L.H. plate assembly.
4. Remove timing belt (item 45) and pulley (item 44) from recorder assembly.
5. Remove 3 machine screws securing transmission to right hand plate assembly and 2 screws securing motor mounting bracket to chassis.
6. Slide drive assembly out of hole in L.H. plate assembly.
7. Slide new or repaired drive assembly into recorder. Watch routing of leads. Be careful not to pinch brown and gray wires going to TB104 on chassis assembly.
8. Secure transmission to right hand side plate assembly and motor mounting bracket to chassis. Replace timing belt and pulley.

9. Replace wires on TB102; blue, TB102-2; green/orange, TB102-5; black, TB102-6.

10. Replace rear cover.

11. Install recorder in case.

## 6.11 POWER TRANSFORMER REPLACEMENT

**NOTE:** Refer to illustrated parts breakdown of chassis assembly in Section VIII.

Replace power transformer(s) (item 5) as follows:

1. Remove recorder from case per paragraph 6.9.
2. Remove paper supply roll per paragraph 6.3.
3. Remove two machine screws securing transformer to chassis (4).
4. Slide out defective transformer and replace.
5. Secure transformer with machine screws.
6. Replace paper supply roll and install recorder in case.

## 6.12 TABLE ASSEMBLY REPLACEMENT

**NOTE:** Refer to illustrated parts breakdowns of L.H. Plate & Writing Table assemblies in Section VIII.

Replace table assembly as follows:

1. Remove recorder from case per paragraph 6.9.
2. Remove paper supply roll per paragraph 6.3.
3. Remove catch (item 15) from L.H. Plate Assembly.
4. Remove retaining rings from table arms and carefully pry arms out of plate assemblies. Do not bend arms.
5. Tilt table slightly and pull out of recorder removing right and left hand lever assemblies.
6. Mount new or repaired table assembly on lever assemblies. Slide table into recorder and snap arms into side plate holes. Replace retaining rings.



7. Replace catch and washer. Make sure lever is below catch.
8. Replace paper supply roll and install recorder in case.

### 6.13 MANIFOLD ASSEMBLY REPLACEMENT

**NOTE:** Refer to illustrated parts breakdown of recorder assembly in Section VIII.

Replace manifold assembly (item 25) as follows:

1. Remove recorder from case per paragraph 6.9.
2. Turn OFF cartridge(s) and all ink valves.
3. Place paper towels around area underneath manifold assembly.
4. Pull off ink tubing from manifold to pens and manifold to ink cartridge(s).
5. Remove four machine screws which secure manifold assembly to side plates. Lift out manifold assembly.
6. Install new or repaired manifold assembly.
7. Replace tubing to manifold assembly.
8. Turn ON ink cartridge(s) and ink valves. Check for leaks.
9. Install recorder in case.

### 6.14 PENMOTOR REPLACEMENT

**NOTE:** Refer to illustrated parts breakdowns of recorder assembly, manifold assembly and penmotor bar assembly.

Replace penmotor as follows:

1. Remove recorder from case per paragraph 6.9.
2. Turn OFF manifold valve to penmotor to be replaced.
3. Place paper towels around area underneath penmotor to be replaced.
4. Pull off ink tubing from pen assembly.
5. Loosen the four machine screws which secure the manifold assembly. Raise manifold assembly as far as it will go and snug screws.
6. Remove paper supply roll (see paragraph 6.3).
7. Remove pen assembly by loosening the two screws which secure it to drive arm and carefully slide off. Refer to Figure 6-10.
8. Remove two socket head screws which secure penmotor to penmotor bar. Disconnect plug and pull penmotor out of recorder. The saddle is a loose part.
9. Install new penmotor, securing with the two socket head screws. Connect plug to penmotor.
10. Loosen manifold assembly screws, lower manifold assembly, and tighten screws.
11. Replace paper supply roll and close table.
12. Install pen assembly per paragraph 6.7a, steps 6 through 13.
13. Install recorder in case.



## 6.15 REPLACING PENMOTOR DRIVE BAND (684999)

**CAUTION:** IT IS RECOMMENDED THAT THE DRIVE BAND BE REPLACED AT THE FACTORY SO THAT PROPER BAND TENSION IS MAINTAINED. SHOULD FIELD REPLACEMENT BECOME NECESSARY, PERFORM THE FOLLOWING STEPS.

**NOTE:** Refer to Figure 6-12 for location of parts in capital letters.

### a. Band Removal

1. Remove Analog Pen Assembly.
2. Loosen (but do NOT remove) screws securing FRONT and REAR BAND CLAMPS.
3. Remove DRIVE BAND by sliding FREE END in counterclockwise direction from between REAR CLAMP and ANCHOR, then from between FRONT CLAMP and PULLEY.
4. Conclude removal by gently unhooking band from BAND ANCHOR.

### b. Band Replacement

1. Place hooked (or bent) end of DRIVE BAND over ANCHOR as shown, and reinstall in clockwise direction between FRONT CLAMP and PULLEY, then between REAR CLAMP and ANCHOR.
2. Apply 5.5 to 6.5 pounds tension to FREE END OF BAND with a spring clamp and spring tension scale or equivalent.

**NOTE:** Be sure that tension is applied directly in line with band i.e., does not pull band forward or back.

3. Maintaining tension, fully tighten all screws and apply a drop of Red Glyptal or equal at screwheads and mating surfaces.
4. Remove spring scale and spring clamp.
5. Reinstall Analog Pen.
6. Check frequency response for compliance with specifications given in Section I.

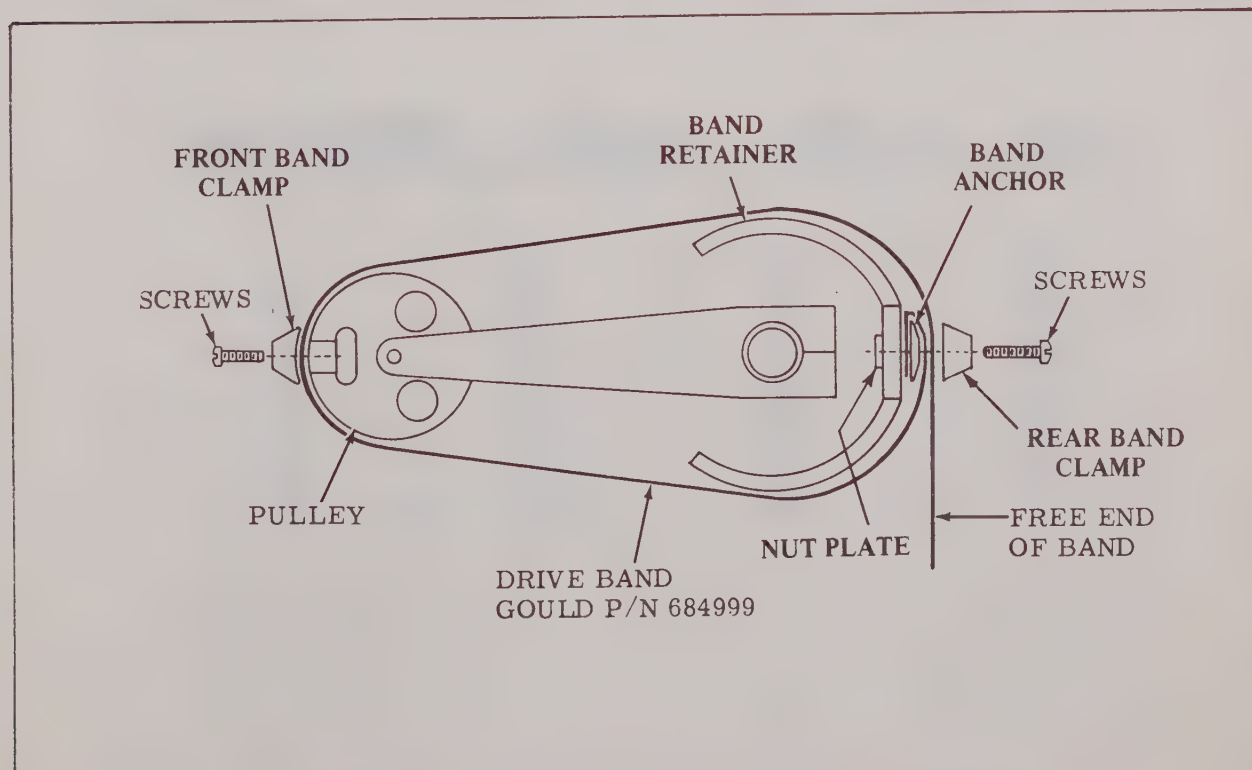


FIGURE 6-12 PENMOTOR DRIVE BAND REPLACEMENT



## SECTION VII

### CALIBRATION

#### 7.1 GENERAL

The Gould 2000 Series Recorder has been factory calibrated. Under normal conditions, it will not be required. However, calibration may be required when parts are replaced. This section describes the procedures necessary to calibrate the 2000 Series Recorder. Calibration should only be performed by qualified individuals.

#### 7.2 TEST EQUIPMENT REQUIRED

Proper test equipment is essential. Use the equipment specified below or its equal.

- a. Function Generator - Wavetek Model 110.
- b. DC Calibration Source - Digitec Model 311.

#### 7.3 PRELIMINARY SETUP

- a. If the recorder contains preamplifiers, remove each preamplifier from its cage prior to calibrating the channel.

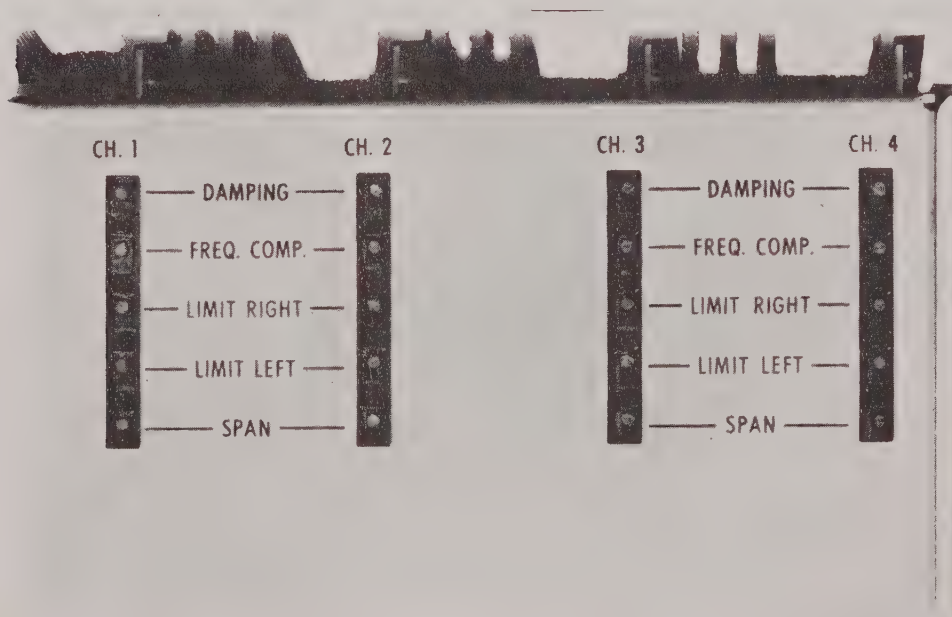
- b. Depress recorder STOP button.
- c. Plug ac line cord into the proper ac voltage source.
- d. Turn ON the recorder.

#### 7.4 CALIBRATION PROCEDURE

Calibration is required on pen drive amplifiers (one per channel) and preamplifiers (if recorder is so equipped). Only pen drive amplifier calibration is discussed in this manual. Refer to the applicable preamplifier manual for its calibration.

Calibration controls and procedures are identical for all channels. Refer to Figure 7-1 and calibrate each pen drive amplifier as follows:

1. Remove the Recorder top rear cover to gain access. Slide cover back and lift out.
2. Connect dc calibration source to phone jack input of drive amplifier. Tip is high, ring is low.



bi 1547

FIGURE 7-1. CALIBRATION CONTROLS



## CALIBRATION

3. Press recorder 5mm/sec CHART SPEED pushbutton.
4. Set dc calibration source to ZERO.
5. Set pen at channel center with pen position control.
6. Apply a +2.5 vdc  $\pm 0.25$  mv signal to drive amplifier and adjust SPAN potentiometer (R-260) for full scale deflection within 0.1%.
7. Return dc calibration source to zero.
8. Turn pen position control full counterclockwise. Pen should deflect left to between 1.0 and 2.0 mm beyond full scale.
9. If deflection is NOT between 1.0 and 2.0 mm beyond full scale, adjust LEFT LIMIT potentiometer (R-208) for a  $1.5 \pm 0.25$  mm deflection beyond full scale.
10. Turn pen position control full clockwise. Pen should deflect right to between 1.0 and 2.0 mm beyond full scale.
11. If deflection is NOT between 1.0 and 2.0 mm beyond full scale, adjust RIGHT LIMIT potentiometer (R-205) for a  $1.5 \pm 0.25$  mm deflection beyond full scale.
12. Connect function generator.
13. Apply a 4V p-p square wave with a 1.0Hz repetition rate.
14. Turn DAMPING potentiometer (R-231) clockwise until an overshoot is obtained. Then, turn slowly counterclockwise until overshoot is reduced to zero.
15. Check overshoot at 20 and 100 percent pen deflection. No overshoot should be present. Repeat Step 14 if necessary.
16. Increase chart speed to 25 mm/sec.
17. Apply a 5Hz sine wave, and adjust amplitude to obtain a 40 mm pen deflection.
18. Slowly increase frequency to 50Hz. Pen deflection should be within 0.5 mm of that at 5Hz.
19. If necessary, adjust FREQUENCY COMP potentiometer (R-209) until 50Hz deflection is within 0.5 mm of the 5Hz deflection.



## SECTION VIII

### PARTS IDENTIFICATION

#### 8.1 GENERAL

This Gould 2400 Series Recorder has been accurately calibrated and adjusted before shipment from the factory, and should give long trouble-free service. For servicing beyond the scope of the instructions contained in this manual or the technical equipment available, contact your nearest Gould Service Engineer listed on the warranty card shipped with the recorder.

The following parts lists and schematic diagram are designed to assist in servicing and repairing the recorder. For replacement parts, refer to the appropriate Figure and Parts List that follow. The items listed do not necessarily imply they are procurable. If an item is marked with an asterisk (\*), it is unprocurable.

To assure prompt and satisfactory delivery of replacement parts, include the following information with your purchase order:

1. Name and model number of the instrument.
2. Description of part as listed in this manual.
3. Gould part number.

**NOTE:** Do not use the SYMBOL NUMBER from the parts list for identifying desired parts on the order.

#### 8.2 PARTS USED ON OTHER MODELS

The USED ON column identifies the recorder on which the part is used. If on code is not present, part is common to all models. Below are the codes and explanations:

| CODE   | EXPLANATION                                 |
|--------|---------------------------------------------|
| 250-2  | 250 mm chassis, 2 channel                   |
| 250-3  | 250 mm chassis, 3 channel                   |
| 250-4  | 250 mm chassis, 4 channel                   |
| 250-XP | 250 mm chassis, (X) channel<br>with preamps |



EXPLODED VIEW PARTS LIST  
 2400 SERIES RECORDER – ALL PORTABLE MODELS  
 FIGURE 8-1

| ITEM<br>NUMBER | PART<br>NUMBER | DESCRIPTION                                    | USED<br>ON    |
|----------------|----------------|------------------------------------------------|---------------|
|                | 2007-42XX-XX   | 2400 Recorder, 2 Channel                       |               |
|                | 2007-43XX-XX   | 2400 Recorder, 3 Channel                       |               |
|                | 2007-44XX-XX   | 2400 Recorder, 4 Channel                       |               |
| 1              | 2007-4290-XX   | Recorder Assy, 2 Channel (See Fig. 8-3)        | 250-2&2P      |
|                | 2007-4390-XX   | Recorder Assy, 3 Channel (See Fig. 8-3)        | 250-3&3P      |
|                | 2007-4490-XX   | Recorder Assy, 4 Channel (see Fig. 8-3)        | 250-4&4P      |
| 2              | 886569         | Case Assy, Recorder (See Fig. 8-18)            | 250-2, 3, & 4 |
|                | 886492         | Case Assy, Recorder, 2 Ch. (See Fig. 8-18)     | 250-2P        |
|                | 886399         | Case Assy, Recorder, 3 & 4 Ch. (See Fig. 8-18) | 250-3P & 4P   |
| 3              | 292819         | Shim (Not Shown)*                              |               |
| 4              | 292818         | Spacer (Not Shown)*                            | 250-XP        |
| 5              | 888321         | Cage Assy, Preamp, 2 Ch. (See Fig. 8-19)       | 250-2P        |
|                | 886400         | Cage Assy, Preamp, 3 & 4 Ch. (See Fig. 8-19)   | 250-3P&4P     |
| 6              | 887005         | Panel Assy                                     | 250-3P        |
| 7              | 11-6402-11     | Chart Takeup Assy (See Fig. 8-23)              |               |

\*Shim location. Top flange of side plates. One each plate.

\*Spacer location. Top of preamp cage.



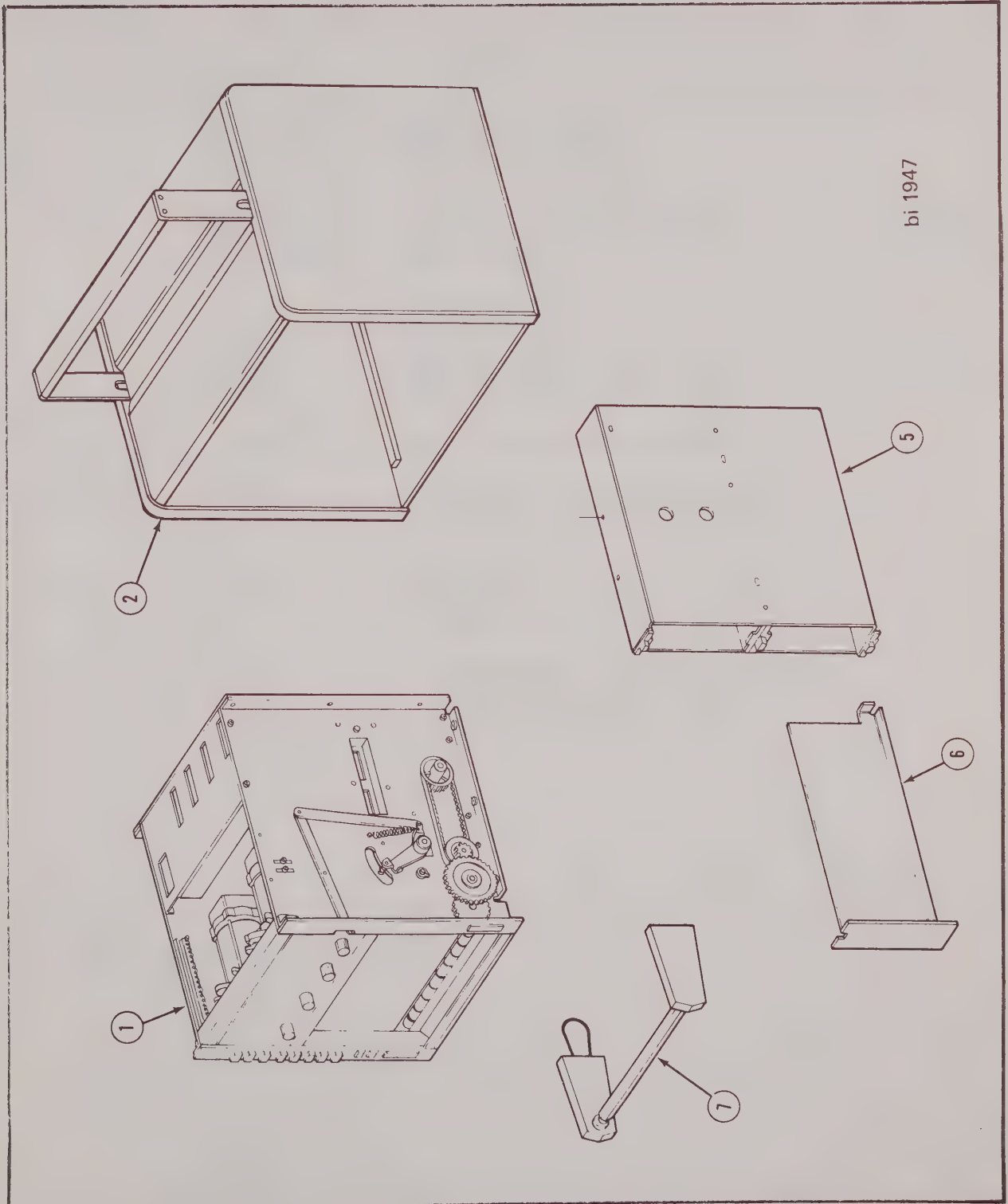


FIGURE 8-1 2400 SERIES RECORDER, PORTABLE



EXPLODED VIEW PARTS LIST  
 2400 SERIES RECORDER – RACK MOUNTED MODELS  
 FIGURE 8-2

| ITEM NO   | PART NUMBER  | DESCRIPTION                                                                                                           | USED ON     |
|-----------|--------------|-----------------------------------------------------------------------------------------------------------------------|-------------|
|           | 2007-42XX-XX | 2400 Recorder, 2 Channel                                                                                              |             |
|           | 2007-43XX-XX | 2400 Recorder, 3 Channel                                                                                              |             |
|           | 2007-44XX-XX | 2400 Recorder, 4 Channel                                                                                              |             |
| 1         | 2007-4290-XX | Recorder Assy, 2 Chan. (See Fig. 8-3)                                                                                 | 250-2&2P    |
|           | 2007-4390-XX | Recorder Assy, 3 Chan. (See Fig. 8-3)                                                                                 | 250-3&3P    |
|           | 2007-4490-XX | Recorder Assy, 4 Chan (See Fig. 8-3)                                                                                  | 250-4&4P    |
| 2         | 467037       | Frame, Shipping                                                                                                       |             |
| 3         | 11-1154-61   | Cabinet Assembly                                                                                                      |             |
| 4         | 887005       | Panel Assembly                                                                                                        | 250-3P      |
| 5         | 888321       | Cage Assy, Preamp (See Fig. 8-19)                                                                                     | 250-2P      |
|           | 886400       | Cage Assy, Preamp (See Fig. 8-19)                                                                                     | 250-3P & 4P |
| 6         | 11-6402-11   | Chart Take-up Assy (See Fig. 8-23)                                                                                    |             |
| Not Shown | ** 687330    | Kit Assy, Model 11-1202-11 (See Fig. 8-20)<br>(Rack Mount Installation Instructions,<br>Recorder only.                |             |
| Not Shown | ** 687363    | Kit Assy, Model 11-1202-12 (See Fig. 8-21)<br>(Rack Mount Installation Instructions,<br>Recorder with 2-preamp cage). |             |
| Not Shown | ** 687361    | Kit Assy, Model 11-1202-13 (See Fig. 8-22)<br>(Rack Mount Installation Instructions,<br>Recorder with 4-preamp cage)  |             |

\*\*Use Kit Model number for ordering purposes.



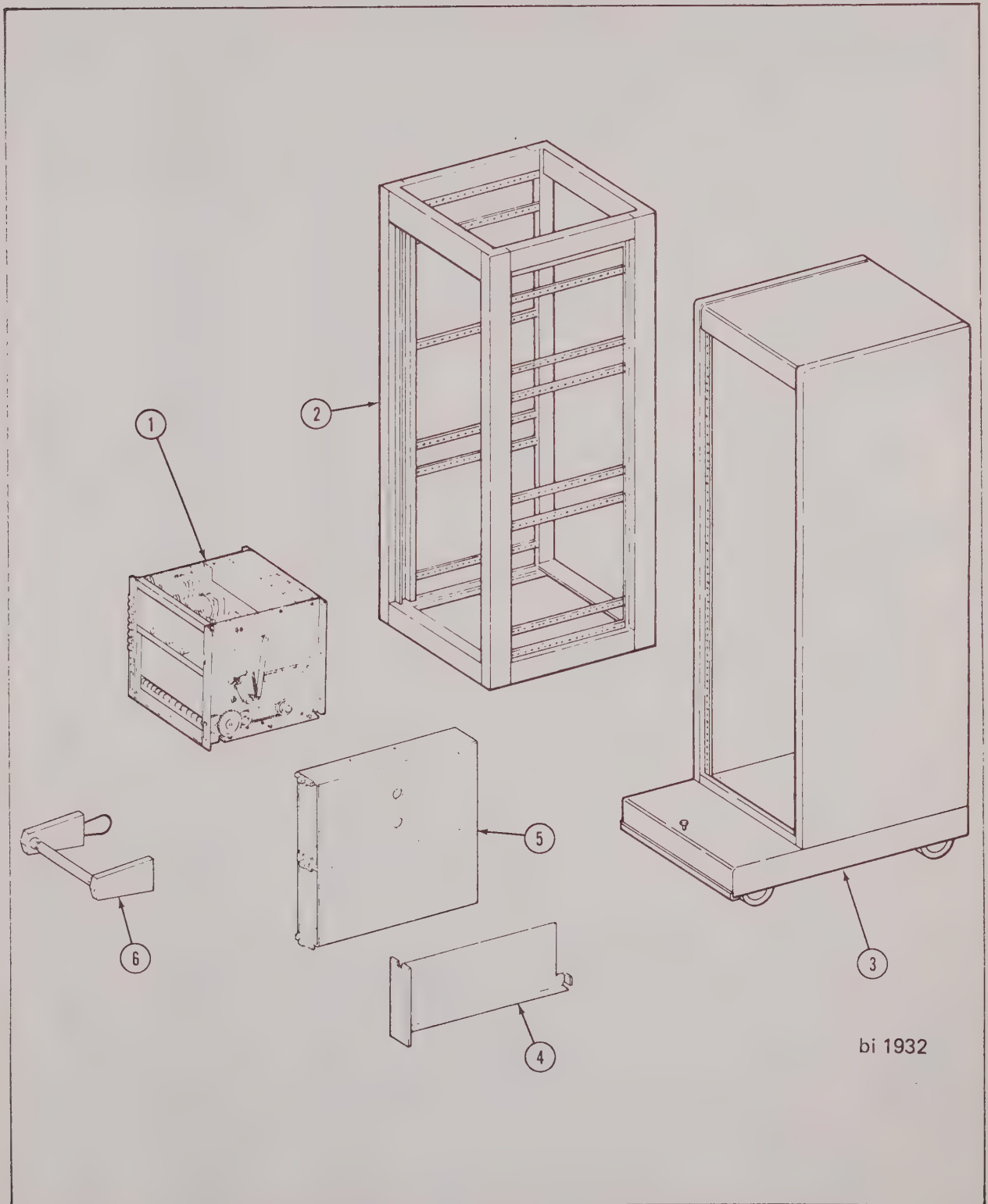


FIGURE 8-2 2400 SERIES RECORDER, RACK MOUNTED MODELS



## EXPLODED VIEW PARTS LIST

2400 SERIES RECORDER – ALL MODELS

RECORDER ASSEMBLY 250mm CHASSIS – 2007-4X90-XX

FIGURE 8-3

| ITEM<br>NUMBER | PART<br>NUMBER | DESCRIPTION                          | SYMBOL<br>NUMBER                                           | USED<br>ON   |
|----------------|----------------|--------------------------------------|------------------------------------------------------------|--------------|
| 1              | 886772-1       | Board Assy Sw, ÷ 60, (See Fig. 8-4)  | A-110                                                      |              |
|                | 886772         | Board Assy Sw, ÷ 100, (See Fig. 8-4) | A-110                                                      |              |
| 2              | 286767         | Insulator                            |                                                            |              |
| 3              | 248169-2       | Spacer                               |                                                            |              |
| 4              | 11-2730-01     | Ink Cartridge                        |                                                            |              |
| 5              | 885098-1       | Plate Assy, L.H. (See Fig. 8-5)      |                                                            | 250-2        |
|                | 885098         | Plate Assy, L.H. (See Fig. 8-5)      |                                                            | 250-3 & 4    |
| 6              | 885291         | Connector Assy (See Fig. 8-6)        |                                                            | 250-4        |
|                | 886771         | Connector Assy (See Fig. 8-6)        |                                                            | 250-3        |
|                | 886773         | Connector Assy (See Fig. 8-6)        |                                                            | 250-2        |
| 7              | 785170-1       | Door Assembly                        |                                                            | 250-4        |
|                | 785170-2       | Door Assembly                        |                                                            | 250-2        |
|                | 785170-3       | Door Assembly                        |                                                            | 250-3        |
| 8              | 285651-3       | Knob                                 |                                                            |              |
| 8A             | 694245         | Knob Assembly, Locking (Not Shown)   |                                                            |              |
| 8B             | 1- 293279-1    | Nut, Plain Hexagon (Not Shown)       |                                                            |              |
| 9              | 386274         | Slide                                |                                                            |              |
| 10             | 285711         | Spring                               |                                                            |              |
| 11             | 886031         | Bracket Assy, Bottom                 |                                                            |              |
| 12             | 286027         | Panel, Filler                        |                                                            | 250-2 & 3    |
| 13             | 886220         | Board Assy, Drive Amp (See Fig. 8-8) | A-101 thru A-104                                           |              |
| 14             | 886327         | Board Assy, Control (See Fig. 8-7)   | A-109                                                      |              |
| 15             | 886033         | Bracket Assy, Top                    |                                                            |              |
| 16             | 116198-X       | Fuse (115V Models)                   | See Table 8-1, Fuse Table<br>Following Fig. 8-3 Parts List |              |
|                | 266924-X       | Fuse (230V Models)                   |                                                            |              |
| 17             | 114816-15      | Plug                                 | P-201                                                      |              |
| 18             | 289046         | Plug                                 | P-202                                                      |              |
| 19             | 786028         | Cover Assembly, Rear                 |                                                            |              |
| 20             | 108572-11      | Strain Relief                        |                                                            |              |
| 21             | 3-113294-61    | Button, Plug                         |                                                            | 250-2        |
| 22             | 244165         | Connector, Receptacle                | J-102                                                      |              |
| 23             | 1-286155-16    | Terminal Board                       | TB-101                                                     |              |
| 24             | 129699         | Jumper                               |                                                            |              |
| 25             | 289225-2       | Shield                               |                                                            |              |
| 26             | 1-280875-8     | Spacer, Threaded                     |                                                            |              |
| 27             | 681257-1       | Cable Assy, Power                    | P-101                                                      |              |
| 28             | 1-280875-7     | Spacer, Threaded                     |                                                            |              |
| 29             | 289227-2       | Shield, Insulation                   |                                                            |              |
| 30             | 886568         | Manifold Assy – 115V Models          |                                                            | 250-2        |
|                | 886777         | Manifold Assy – 230V Models          |                                                            | 250-2        |
|                | 886573         | Manifold Assy – 115V Models          |                                                            | 250-3, 250-4 |
|                | 886780         | Manifold Assy – 230V Models          |                                                            | 250-3, 250-4 |
| 30A            | 266888-2       | Solenoid – 115V Models (Not Shown)   | L105, L106                                                 |              |
|                | 266888-3       | Solenoid – 230V Models (Not Shown)   | L105, L106                                                 |              |
| 30B            | 269256-7       | Diode, 1N4007 (Not Shown)            | CR111, CR112                                               |              |
| 30C            | 684169-1       | Valve Assy (Not Shown)               |                                                            |              |



## EXPLODED VIEW PARTS LIST

2400 SERIES RECORDER – ALL MODELS

RECORDER ASSEMBLY 250mm CHASSIS - 2007-4X90-XX

FIGURE 8-3 (Cont'd)

| ITEM<br>NUMBER | PART<br>NUMBER                                    | DESCRIPTION                                           | SYMBOL<br>NUMBER | USED<br>ON |
|----------------|---------------------------------------------------|-------------------------------------------------------|------------------|------------|
| 31             | 886667                                            | Bracket Assy, Shield-60Hz Models<br>(See Fig. 8-9)    |                  |            |
|                | 887098                                            | Bracket Assy, Shield - 400Hz Models<br>(See Fig. 8-9) |                  |            |
|                | 886921                                            | Bracket Assy, Shield - 50Hz Models<br>(See Fig. 8-9)  |                  |            |
| 32             | 786034                                            | Shield                                                |                  |            |
| 33             | 786030                                            | Cover Assy, Rear - 50/60Hz Models                     |                  |            |
|                | 787099                                            | Cover Assy, Rear - 400Hz Models                       |                  |            |
| 34             | 1-286404-1                                        | Fan Motor - 115V/50-60Hz Models                       | B-102            |            |
|                | 1-286404-2                                        | Fan Motor - 230V/50 Hz Models                         | B-102            |            |
|                | 1-286690-1                                        | Fan Motor - 115V/400 Hz Models                        | B-102            |            |
| 35             | 287389                                            | Bracket Connector                                     |                  | 250-2      |
| 36             | 885083                                            | Plate Assy, R.H. (See Fig. 8-13)                      |                  |            |
| 37             | 243542-6                                          | Belt, Timing                                          |                  |            |
| 38             | 385806                                            | Pulley                                                |                  |            |
| 39             | 686429                                            | Indicator Assy                                        |                  |            |
| 40             | 286592                                            | Spring                                                |                  |            |
| 41             | 1-227070-3                                        | Retaining Ring                                        |                  |            |
| 42             | 683485                                            | Brake Assy (See Fig. 8-12)                            |                  |            |
| 43             | 286531                                            | Spring                                                |                  |            |
| 44             | 1-227070-9                                        | Ring, Retaining                                       |                  |            |
| 45             | 127271                                            | Washer                                                |                  |            |
| 46             | 269491                                            | Gear, Dual                                            |                  |            |
| 47             | 385710                                            | Gear-Pulley                                           |                  |            |
| 48             | 269499                                            | Gear, Spur                                            |                  |            |
| 49             | 1-227070-9                                        | Ring, Retaining                                       |                  |            |
| 50             | 127271                                            | Washer                                                |                  |            |
| 51             | 265741-1                                          | Bearing, Ball                                         |                  |            |
| 52             | 265745-1                                          | Washer, Mylar                                         |                  |            |
| 53             | 241513-206                                        | Capacitor, 115V Models                                | C-108            |            |
|                | 231449-27                                         | Capacitor, 230V Models                                | C-108            |            |
| *54            | See Table 8-2<br>Following Fig. 8-3<br>Parts List | Chassis Assembly (See Fig. 8-15)                      |                  |            |
| 55             | 785133                                            | Harness Assembly, Transmission                        |                  |            |
| 56             | 286770                                            | Cover, Panel                                          |                  |            |
| 57             | 786396                                            | Panel Assy, Front R.H.                                |                  |            |
| 58             | 785701-1                                          | Chute, Paper                                          |                  |            |
| 59             | 267426-1                                          | Paper Deflector                                       |                  |            |

\*Item 54 is not procurable. Refer to Figure 8-15 parts list.



EXPLODED VIEW PARTS LIST  
 2400 SERIES RECORDER — ALL MODELS  
 RECORDER ASSEMBLY 250mm CHASSIS - 2007-4X90-XX  
 FIGURE 8-3 (Cont'd)

| ITEM<br>NUMBER | PART<br>NUMBER | DESCRIPTION                                                                                                                 | SYMBOL<br>NUMBER | USED<br>ON   |
|----------------|----------------|-----------------------------------------------------------------------------------------------------------------------------|------------------|--------------|
| 60             | 685719         | Roll, Drive                                                                                                                 |                  |              |
| 61             | 783590         | Sensor Assembly (See Fig. 8-14)                                                                                             |                  |              |
| *62            | 785169         | Bar Assy, Penmotor 4 Channel (See Fig. 8-10)                                                                                |                  | 250-4        |
|                | 785171         | Bar Assy, Penmotor 2 Channel (See Fig. 8-10)                                                                                |                  | 250-2        |
|                | 785175         | Bar Assy, Penmotor 3 Channel (See Fig. 8-10)                                                                                |                  | 250-3        |
| 63             | 11-2823-42     | Pen Assembly                                                                                                                |                  |              |
| 63A            | 687477-1       | Ink Tube (Analog Pen-Not Shown)                                                                                             |                  |              |
| 64             | 11-2123-35     | Interchannel Event Marker (See Fig. 8-11)                                                                                   |                  |              |
| 64A            | 667447-3       | Ink Tube (Event Marker - Not Shown)                                                                                         |                  | 250-2        |
| 64B            | 667277         | Ink Tube (Event Marker - Not Shown)                                                                                         |                  | 250-3, 250-4 |
| 65             | 285357-1       | Shaft                                                                                                                       |                  |              |
| 66             | 785745         | Shaft Assy, Supply                                                                                                          |                  |              |
| 67             | 785718         | Flange Assy, Supply                                                                                                         |                  |              |
| 68             | 885748         | Table Assy, Writing (See Fig. 8-17)                                                                                         |                  |              |
| 69             | 285765-1       | Lamp                                                                                                                        | DS-101,DS-102    |              |
| 70             | 685196-1       | Lampholder, Assembly                                                                                                        |                  |              |
| 71             | 685196-2       | Lampholder, Assembly                                                                                                        |                  |              |
| 72             | 285764-4       | Lens                                                                                                                        |                  |              |
| 73             | 285764-1       | Lens                                                                                                                        |                  |              |
| 74             | 786393         | Panel Assy, Front L.H.                                                                                                      |                  |              |
| 75             | 2-240731-10    | Ring, Retaining                                                                                                             |                  |              |
| 76             | 691288         | Jumper Assy (Not Shown - Connects inner<br>surface of door Assy, item 7, and inner surface<br>of R.H. Plate Assy, item 36.) |                  |              |

\*Item 62 is not procurable. Order parts from Figure 8-10 itemized parts list.



TABLE 8-1 FUSE TABLE ( ITEM 16 )

| FUSE<br>SYMBOL            | LINE VOLTAGE & FREQUENCY |                         |                        |                        |
|---------------------------|--------------------------|-------------------------|------------------------|------------------------|
|                           | 115V/60HZ                | 115V/50HZ               | 115V/400HZ             | 230V/50HZ              |
| F101 thru F104            | 116198-9<br>3/4A, 125V   | 116198-10<br>1A, 125V   | 116198-9<br>3/4A, 125V | 266924-7<br>1/2A, 250V |
| F109                      | 116198-6<br>1/4A, 125V   | 116198-7<br>3/8A, 125V  | 116198-6<br>1/4A, 125V | 266924-2<br>1/4A, 250V |
| F110                      | 116198-6<br>1/4A, 125V   | 116198-6<br>1/4A, 125V  | 116198-6<br>1/4A, 125V | 266924-4<br>1/8A, 250V |
| F111<br>W/1-Ink Solenoid  | 116198-6<br>1/4A, 125V   | 116198-6<br>1/4A, 125V  | 116198-6<br>1/4A, 125V | 266924-4<br>1/8A, 250V |
| F111<br>W/2-Ink Solenoids | 116198-8<br>1/2A, 125V   | 116198-8<br>1/2A, 125V  | 116198-8<br>1/2A, 125V | 266924-2<br>1/4A, 250V |
| F112                      | 116198-11<br>1.5A, 125V  | 116198-11<br>1.5A, 125V | 116198-36<br>7A, 125V  | 266924-6<br>3/4A, 250V |
| F113                      | 116198-13<br>3A, 125V    | 116198-13<br>3A, 125V   | 116198-13<br>3A, 125V  | 266924-1<br>1.5A, 250V |



TABLE 8-2 CHASSIS ASSEMBLY TABLE (ITEM 54)

| LINE VOLTAGE, FREQUENCY<br>& CHART SPEED DIVISOR | CHASSIS ASSEMBLY PART NUMBER |           |           |
|--------------------------------------------------|------------------------------|-----------|-----------|
|                                                  | 4 CHANNEL                    | 3 CHANNEL | 2 CHANNEL |
| 115V/60Hz, $\div$ 100                            | 786572                       | 785176    | 786570    |
| 115V/50Hz, $\div$ 100                            | 786778                       | 786839    | 786881    |
| *115V/400Hz, $\div$ 100                          | 887097-1                     | 887097-3  | 887097-2  |
| 230V/50Hz, $\div$ 100                            | 786899                       | 786897    | 786895    |
| 115V/60Hz, $\div$ 60                             | 786572-1                     | 785176-1  | 786570-1  |
| 115V/50Hz, $\div$ 60                             | 786778-1                     | 786839-1  | 786881-1  |
| *115V/400Hz, $\div$ 60                           | 887097-1                     | 887097-3  | 887097-2  |
| 230V/50Hz, $\div$ 60                             | 786899-1                     | 786897-1  | 786895-1  |

\*NOTE: TRANSMISSION & MOTOR ASSEMBLY FOR 115V/400HZ,  $\div$  100 MODELS ARE 12-2202-16  
AND FOR 115V/400Hz  $\div$  60 MODELS ARE 12-2203-16.



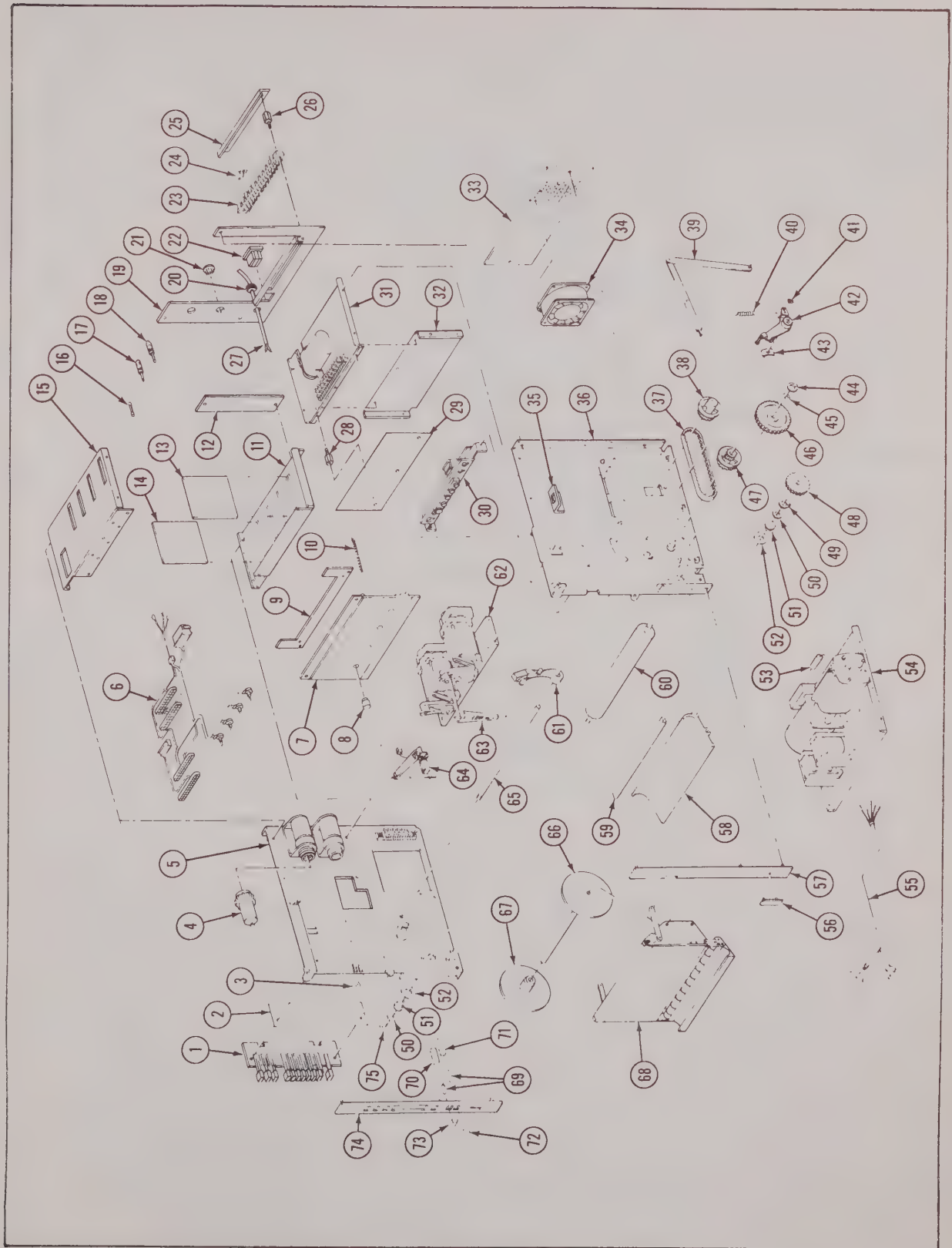


FIGURE 8-3 RECORDER ASSEMBLY



EXPLODED VIEW PARTS LIST  
 2400 SERIES RECORDER – All Models  
 BOARD ASSEMBLY, SWITCH  
 FIGURE 8-4

| ITEM<br>NO | PART<br>NUMBER | DESCRIPTION              | SYMBOL<br>NO | USED<br>ON   |
|------------|----------------|--------------------------|--------------|--------------|
| 1          | 886772         | Board Assy, Switch       |              | ÷ 100 Models |
|            | 886772-1       | Board Assy, Switch       |              | ÷ 60 Models  |
|            | 385804         | Board Printed Circuit    |              |              |
|            | 285758         | Switch, Speed Select     | S-101        |              |
| 3          | 786080-1       | Button, Switch – “POWER” |              |              |
|            | 786080-2       | Button, Switch – “STOP”  |              |              |
|            | 786080-3       | Button, Switch – “5”     |              |              |
|            | 786080-4       | Button, Switch – “10”    |              |              |
|            | 786080-5       | Button, Switch – “25”    |              |              |
|            | 786080-6       | Button, Switch – “50”    |              |              |
|            | 786080-7       | Button, Switch – “100”   |              |              |
|            | 786080-8       | Button, Switch – “200”   |              |              |
|            | 786080-9       | Button, Switch – “÷ 100” |              | ÷ 100 Models |
|            | 786080-10      | Button, Switch – “LEFT”  |              |              |
|            | 786080-11      | Button, Switch – “RIGHT” |              |              |
|            | 786080-12      | Button, Switch – “÷ 60”  |              | ÷ 60 Models  |
| 4          | 265763-3       | Contact                  |              |              |



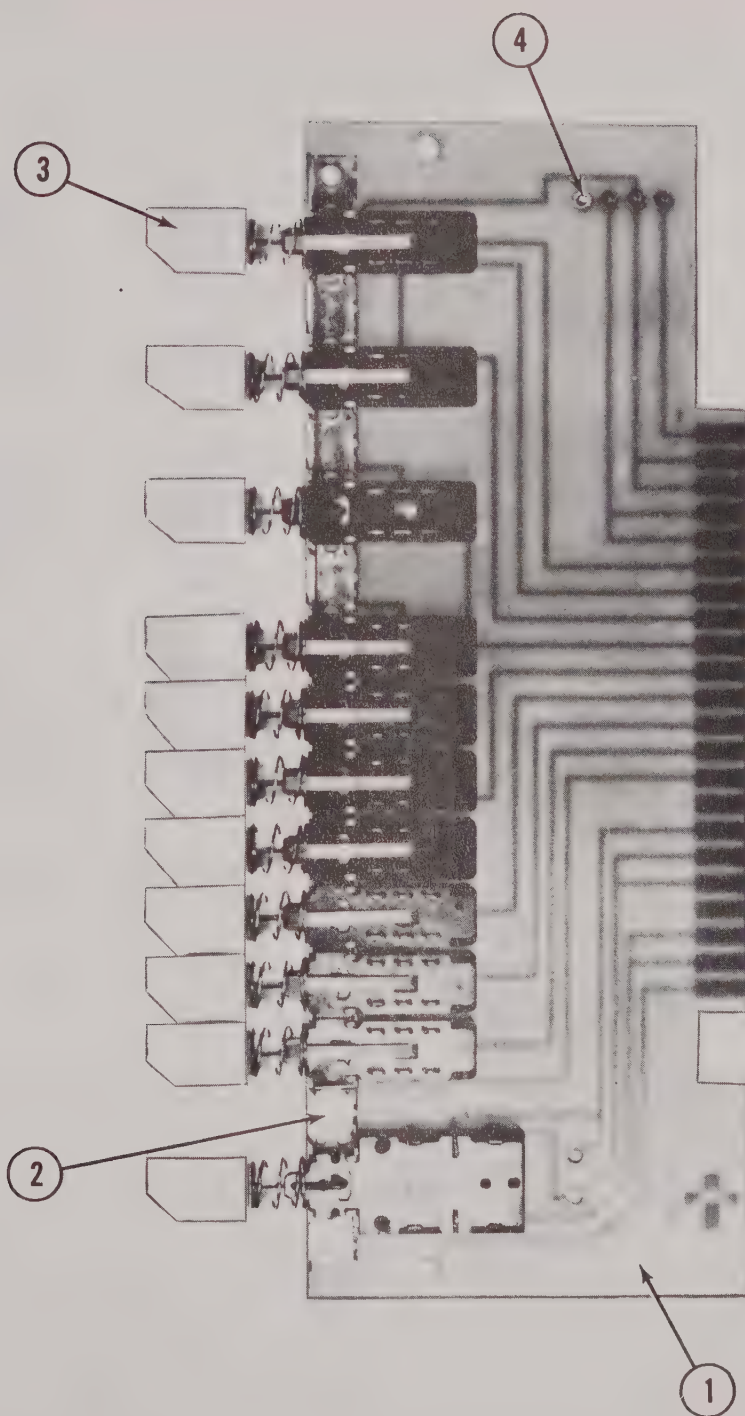


FIGURE 8-4 SWITCH BOARD ASSEMBLY



## PARTS IDENTIFICATION

EXPLODED VIEW PARTS LIST  
 2400 SERIES RECORDER — All Models  
 PLATE ASSEMBLY, L.H.  
 FIGURE 8-5

| ITEM NO                           | PART NUMBER | DESCRIPTION          | SYMBOL NO | USED ON   |
|-----------------------------------|-------------|----------------------|-----------|-----------|
|                                   | 885098      | Plate Assembly, L.H. |           | 250-3 & 4 |
|                                   | 885098-1    | Plate Assembly, L.H. |           | 250-2     |
| 1                                 | 385619      | Bracket, Connector   |           |           |
| 2                                 | 1-265849-4  | Bracket              |           |           |
| **3                               | 885046      | Plate Subassy        |           |           |
| 4                                 | 385543-2    | Guide                |           |           |
| 5                                 | 766243      | Ink Plunger Assy     |           |           |
| 5A                                | 766243      | Ink Plunger Assy     |           | 250-3 & 4 |
| 6                                 | 2-128693-3  | Grommet              |           |           |
| 7                                 | 243622      | Pad, Friction        |           |           |
| 8                                 | 243623      | Spring               |           |           |
| 9                                 | 243611-910  | Lever Assy           |           |           |
| 9A                                | 243440      | Bumper               |           |           |
| 9B                                | 265711      | Catch                |           |           |
| 10                                | 285929      | Bracket, L.H.        |           |           |
| 11                                | 285599      | Catch                |           |           |
| 12                                | 127271      | Washer               |           |           |
| 13                                | 1-227070-9  | Ring, Retaining      |           |           |
| 14                                | 286015-1    | Filter, RFI          | FL101     |           |
| 15                                | 265814-6    | Terminal Board       | TB102     |           |
| **Items 9A and 9B part of item 3. |             |                      |           |           |



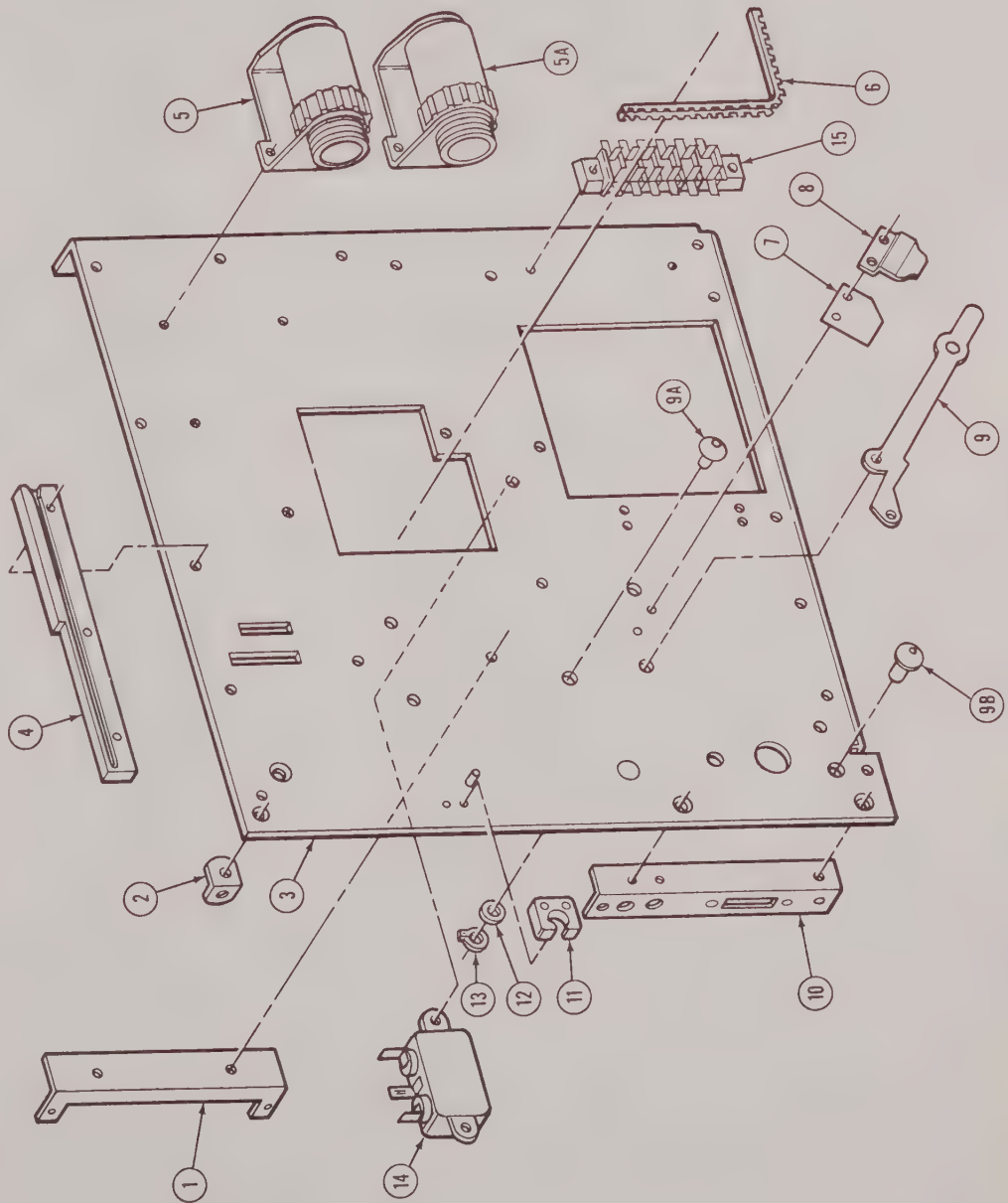


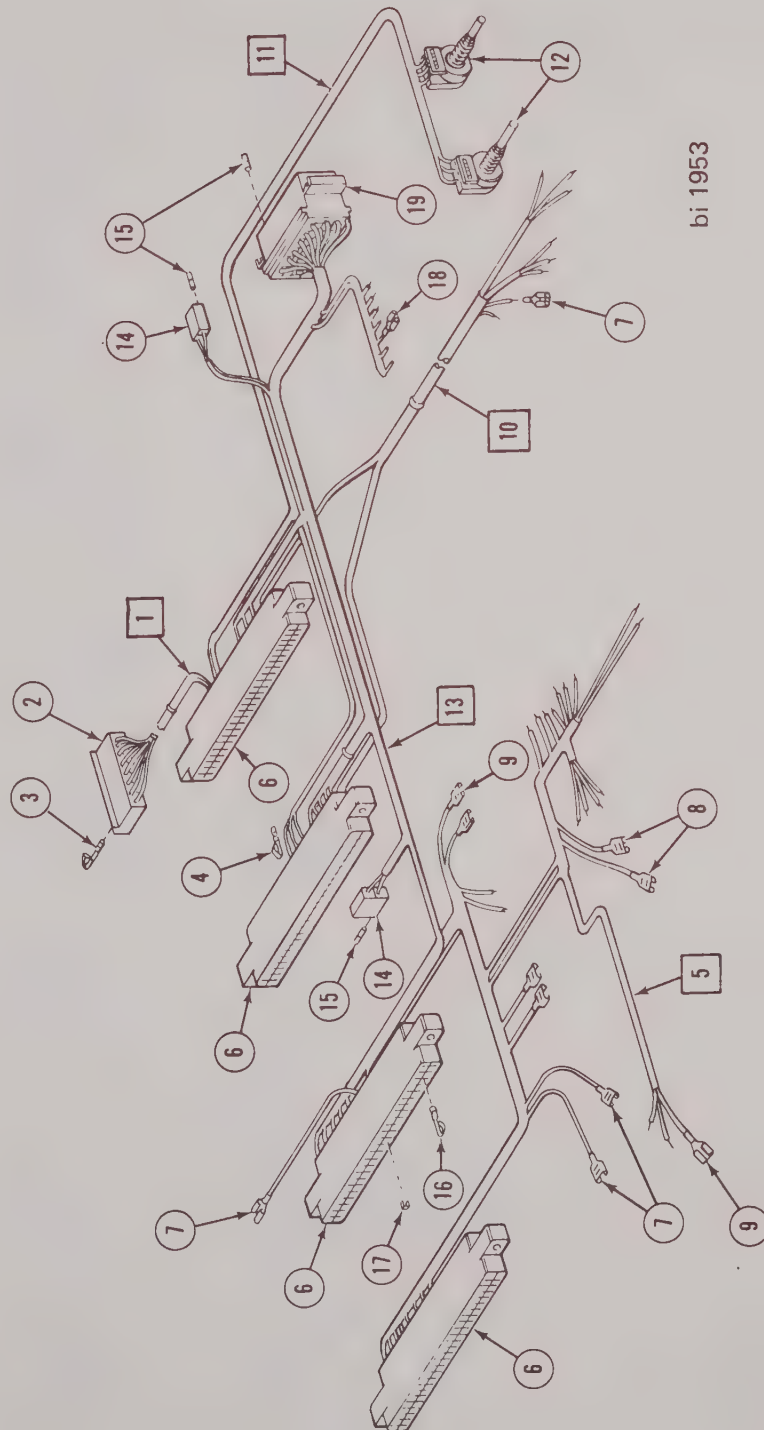
FIGURE 8-5 L. H. PLATE ASSEMBLY



EXPLODED VIEW PARTS LIST  
 2400 SERIES RECORDER – ALL MODELS  
 CONNECTOR ASSEMBLY – 250mm MAINFRAME  
 FIGURE 8-6

| ITEM<br>NUMBER | PART<br>NUMBER | DESCRIPTION                                   | SYMBOL<br>NUMBER           | USED<br>ON |
|----------------|----------------|-----------------------------------------------|----------------------------|------------|
|                | 885291         | Connector Assy - 4 Channel                    |                            | 250-4      |
|                | 886771         | Connector Assy - 3 Channel                    |                            | 250-3      |
|                | 886773         | Connector Assy - 2 Channel                    |                            | 250-2      |
| 1              | 785087         | Harness Assy, Penmotor                        |                            |            |
| 2              | 9-281501-82    | Connector                                     | XM-101-XM-104              |            |
| 3              | 281506-3       | Contact, Electrical                           |                            |            |
| 4              | 1-283408-2     | Contact, Electrical                           |                            |            |
| 5              | 885261         | Harness Assy, Switchboard                     |                            |            |
| 6              | 283420-44      | Connector                                     | XA-101-104,<br>XA-109, 110 |            |
| 7              | 265840-1       | Terminal Lug                                  |                            |            |
| 8              | 270160-1       | Terminal Lug                                  |                            |            |
| 9              | 265915-1       | Terminal Lug                                  |                            |            |
| 10             | 785089         | Harness Assy, Power Xfmr                      |                            |            |
| 11             | 885274         | Harness Assy, Pen Position                    |                            | 250-2      |
|                | 885282         | Harness Assy, Pen Position                    |                            | 250-3      |
|                | 885095         | Harness Assy, Pen Position                    |                            | 250-4      |
| 12             | 10-286044-103  | Resistor, Variable                            | R-101-104                  |            |
| 13             | 887399         | Harness Assy, Drive Amp                       |                            | 250-2      |
|                | 886602-2       | Harness Assy, Drive Amp                       |                            | 250-3      |
|                | 886602-3       | Harness Assy, Drive Amp                       |                            | 250-4      |
| 14             | 9-270159-2     | Connector                                     | P-105, 106                 |            |
| 15             | 270154-1       | Contact, Electrical                           |                            |            |
| 16             | 1-283408-1     | Contact, Electrical                           |                            |            |
|                | 1-283408-2     | Contact, Electrical (use on teflon wire only) |                            |            |
| 17             | 286598         | Commoning Spring (Jumper)                     |                            |            |
| 18             | 286594-1       | Terminal Lug                                  |                            |            |
| 19             | 0-270156-1     | Connector                                     | J-103                      | 250-3 & 4  |
| 19             | 9-270159-15    | Connector                                     | J-103                      | 250-2      |





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FIGURE 8-6 CONNECTOR ASSEMBLY



## ELECTRICAL PARTS LIST

2400 SERIES RECORDER — All Models

CONTROL-TIMER BOARD ASSEMBLY — 886327 (Schematic 292274)

FIGURE 8-7

| SYMBOL<br>NUMBER     | PART<br>NUMBER | DESCRIPTION                          |
|----------------------|----------------|--------------------------------------|
| C101, 102            | 243037-507     | Capacitor                            |
| C103                 | 262585-106     | Capacitor                            |
| C104                 | 240352-102     | Capacitor                            |
| C105                 | 262585-475     | Capacitor                            |
| C106                 | 230098-104     | Capacitor                            |
| CR101                | 286018-2       | Diode, MDA104                        |
| CR102, 103           | 286018-1       | Diode, MDA101                        |
| CR104                | Not Used       |                                      |
| CR105, CR106         | 269256-7       | Diode, 1N4007                        |
| CR123                | 280440         | Diode, 1N4148                        |
| Jumper               | 267235         | Jumper Circuit                       |
| K101                 | 289048-24      | Relay                                |
| Q101, 102, 104       | 292538-2       | Transistor, 2N6427                   |
| R101, 102            | 5-241111-302   | Resistor                             |
| R103                 | 5-241111-242   | Resistor                             |
| R104, 105            | 5-241111-103   | Resistor                             |
| R106                 | 5-241111-271   | Resistor                             |
| R107                 | 5-241111-103   | Resistor                             |
| R108                 | 5-241111-302   | Resistor                             |
| R109                 | 5-241111-304   | Resistor                             |
| S103                 | 268923         | Switch<br>(A-P)                      |
|                      | 285179         | Switchplate                          |
|                      | 31-119918-4004 | Screw                                |
|                      | 1-118195-304   | Washer, Plain                        |
|                      | 1-216741-411   | Lockwasher<br>----- * -----          |
| S104                 | 286142-8       | Switch                               |
| U101                 | 285317         | Voltage Regulator, MC7805CP<br>(A-P) |
|                      | 31-119918-4004 | Screw<br>----- * -----               |
| U102<br>thru<br>U105 | 270622         | Integrated Circuit, 7493             |
| U106                 | 286016         | Integrated Circuit, SN74121          |
| U107                 | 285589         | Isolator, Led, 4N28                  |
| HS                   | 686397         | Heatsink<br>(A-P)                    |
|                      | 31-119918-4004 | Screw                                |
|                      | 1-118195-304   | Washer, Plain                        |
|                      | 1-216741-411   | Lockwasher<br>----- * -----          |
| FC                   | 285577         | Fuse Clip                            |

NOTE: See Table 8-1,  
Fuse Table, for fuse  
ratings.



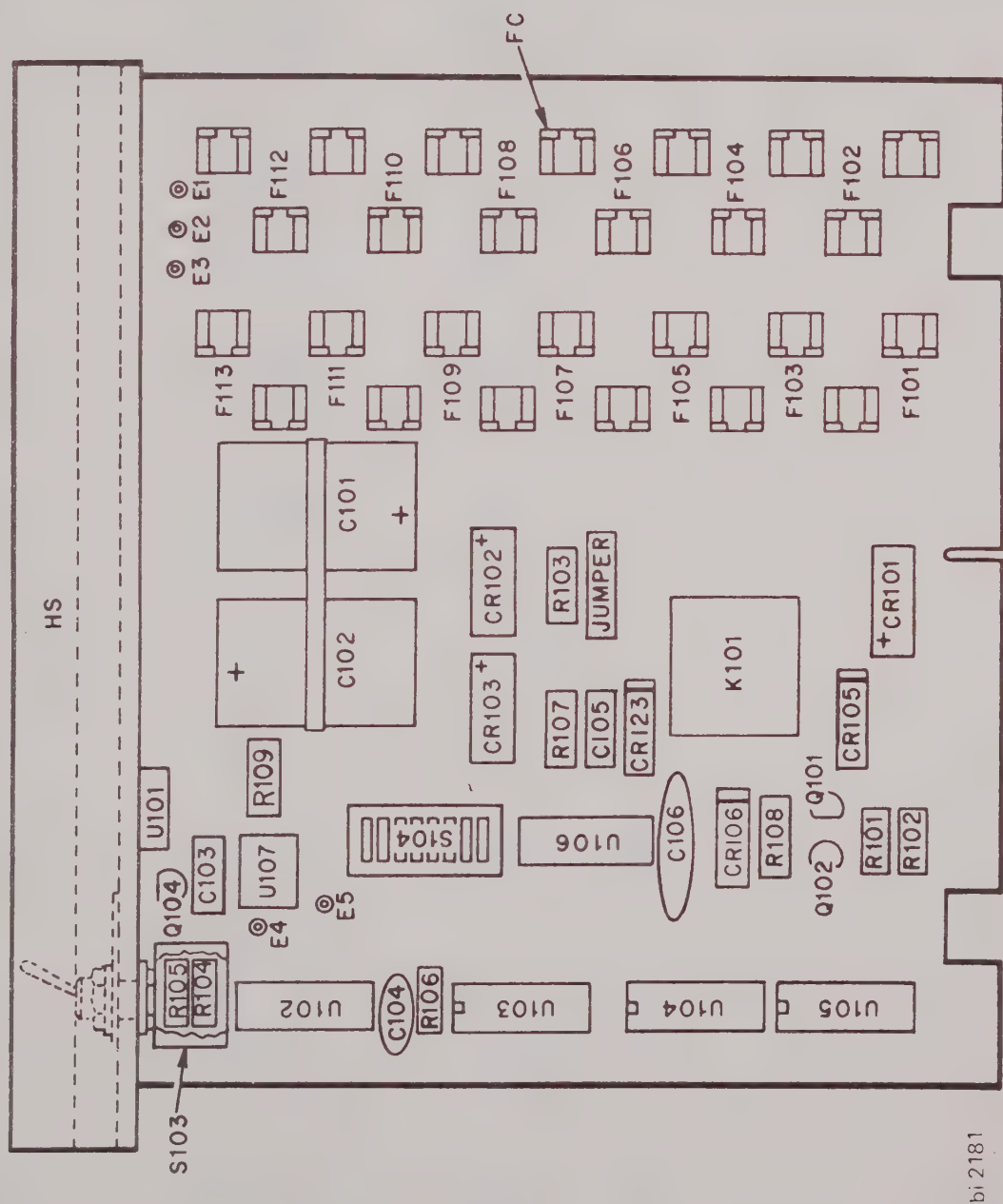


FIGURE 8-7 CONTROL TIMER BOARD ASSEMBLY



## ELECTRICAL PARTS LIST

2400 SERIES RECORDER — All Models

BOARD ASSEMBLY, DRIVE AMPLIFIER — 886220 (Schematic 292273)

FIGURE 8-8

| ITEM<br>NUMBER | PART<br>NUMBER | DESCRIPTION                                 | SYMBOL<br>NUMBER |
|----------------|----------------|---------------------------------------------|------------------|
| C201           | 10-125904-223  | Capacitor                                   |                  |
| C202           | 10-247116-102  | Capacitor                                   |                  |
| C203, 204      | 10-247116-102  | Capacitor                                   |                  |
| C205           | 240352-501     | Capacitor                                   |                  |
| C206           | 10-247116-103  | Capacitor                                   |                  |
| C207           | 240352-501     | Capacitor                                   |                  |
| C208           | 262585-106     | Capacitor                                   |                  |
| C209           | 10-247116-103  | Capacitor                                   |                  |
| C210, 211      | 10-247116-102  | Capacitor                                   |                  |
| C212           | 240352-202     | Capacitor                                   |                  |
| C213           | 10-125904-503  | Capacitor                                   |                  |
| C214           | 10-125904-223  | Capacitor                                   |                  |
| C215           | 281509-507     | Capacitor                                   |                  |
| C216           | 262585-106     | Capacitor                                   |                  |
| C217           | 281509-507     | Capacitor                                   |                  |
| C218           | 262585-106     | Capacitor                                   |                  |
| C219-222       | 286010-108     | Capacitor                                   |                  |
| C223           | 288755-104     | Capacitor (Used only in 80mm applications.) |                  |
| CR201, 202     | 263727         | Diode, 1N961B                               |                  |
| CR203-208      | 270508         | Diode, 1N4454                               |                  |
| CR209, 210     | 286018-1       | Diode, MDA-101                              |                  |
| CR211          | 269256-7       | Diode, 1N4007                               |                  |
| CR212          | 270508         | Diode, 1N4454                               |                  |
| Q201           | 281703-2       | Transistor, 2N4403                          |                  |
| Q202           | 281702-2       | Transistor, 2N4401                          |                  |
| Q203-205       | 286141         | Transistor, 2N3904                          |                  |
| Q206           | 1-230057-3     | Transistor, 2N4923                          |                  |
| Q207           | 1-286145-1     | Transistor, 2N5982<br>(A-P)                 |                  |
|                | 12-119918-4006 | Screw<br>----- * -----                      |                  |
| Q208           | 1-230058-3     | Transistor, 2N4920                          |                  |
| Q209           | 1-286147-1     | Transistor, 2N5985<br>(A-P)                 |                  |
|                | 12-119918-4006 | Screw<br>----- * -----                      |                  |
| Q210           | 281857-2       | Transistor, 2N5033                          |                  |
| R201           | 1-281851-30002 | Resistor                                    |                  |
| R202           | 1-281851-1002  | Resistor                                    |                  |
| R203           | 1-281851-43201 | Resistor                                    |                  |
| R204           | 1-281851-10002 | Resistor                                    |                  |



## ELECTRICAL PARTS LIST

2400 SERIES RECORDER — All Models

BOARD ASSEMBLY, DRIVE AMPLIFIER — 886220 (Schematic 292273)

FIGURE 8-8

| SYMBOL<br>NUMBER | PART<br>NUMBER | DESCRIPTION |
|------------------|----------------|-------------|
| R205             | 282299-103     | Resistor    |
| R206, 207        | 1-281851-69000 | Resistor    |
| R208             | 282299-103     | Resistor    |
| R209             | 282299-202     | Resistor    |
| R210             | 1-281851-200R0 | Resistor    |
| R211             | 1-281851-10002 | Resistor    |
| R212, 213        | 1-281851-10001 | Resistor    |
| R214             | 1-281851-16601 | Resistor    |
| R215, 216        | 1-281851-10000 | Resistor    |
| R217, 218        | 1-281851-80000 | Resistor    |
| R219             | 1-281851-72001 | Resistor    |
| R220             | 1-281851-40000 | Resistor    |
| R221             | 1-281851-80001 | Resistor    |
| R222             | 1-281851-40001 | Resistor    |
| R223, 224        | 5-241111-622   | Resistor    |
| R225             | 5-241111-392   | Resistor    |
| R226, 227        | 1-281851-50001 | Resistor    |
| R228             | 1-281851-10002 | Resistor    |
| R229             | 1-281851-60001 | Resistor    |
| R230             | 1-281851-60000 | Resistor    |
| R231             | 282299-502     | Resistor    |
| R232             | 1-281851-500R0 | Resistor    |
| R233             | 1-281851-10003 | Resistor    |
| R234             | 1-281851-26501 | Resistor    |
| R235             | 5-241111-104   | Resistor    |
| R236             | 5-241111-203   | Resistor    |
| R237             | 5-241111-822   | Resistor    |
| R238             | 5-241111-102   | Resistor    |
| R239, 240        | 5-241111-202   | Resistor    |
| R241             | 5-241111-391   | Resistor    |
| R242             | 5-241111-102   | Resistor    |
| R243             | 5-286587-181   | Resistor    |
| R244             | 5-283654-220   | Resistor    |
| R245             | 5-286587-181   | Resistor    |
| R246             | 5-241111-102   | Resistor    |
| R247             | 1-281851-20001 | Resistor    |
| R248             | 1-281851-500R0 | Resistor    |
| R249, 250        | 1-281851-80000 | Resistor    |
| R251             | 5-241111-104   | Resistor    |
| R252, 253        | 5-241111-103   | Resistor    |



## ELECTRICAL PARTS LIST

2400 SERIES RECORDER — All Models

BOARD ASSEMBLY, DRIVE AMPLIFIER — 886220 (Schematic 292273)

FIGURE 8-8 (Continued)

| SYMBOL<br>NUMBER | PART<br>NUMBER | DESCRIPTION                    |
|------------------|----------------|--------------------------------|
| R254             | 1-281851-16001 | Resistor                       |
| R255             | 1-281851-50000 | Resistor                       |
| R256             | 5-241111-101   | Resistor                       |
| R257             | 1-281851-20001 | Resistor                       |
| R258             | Not Used       |                                |
| R259             | 1-282851-40001 | Resistor                       |
| R260             | 282299-103     | Resistor                       |
| R261             | Not Used       |                                |
| R262             | 5-241111-104   | Resistor                       |
| R263, 264        | 5-130340-2R0   | Resistor                       |
| R265             | 5-241111-822   | Resistor                       |
| U201-204         | 280863-3       | Integrated Circuit, 741C       |
| U205             | 269941-2       | Integrated Circuit, 1439P1     |
| U206             | 280863-3       | Integrated Circuit, 741C       |
| U207             | 285461         | Voltage Reg., MC 7815<br>(A-P) |
|                  | 12-119918-4005 | Screw<br>----- * -----         |
| U208             | 285778         | Voltage Reg., MC 7915<br>(A-P) |
|                  | 12-119918-4005 | Screw<br>----- * -----         |
| U209, 210        | Not Used       |                                |
| U211             | 285589         | Isolator, LED, 4N28            |
| HS               | 686391         | Heatsink<br>(A-P)              |
|                  | 31-119918-4005 | Screw                          |
|                  | 1-118195-304   | Washer                         |
|                  | 1-216741-411   | Lockwasher<br>----- * -----    |
| -----            | 685187         | Jack Assembly                  |
| J201             | 285315         | Jack                           |
| J202             | 289045         | Jack<br>(A-P)                  |
|                  | 1-120052-211   | Lockwasher<br>----- * -----    |
| E1<br>thru<br>E4 | 265763-3       | Contact                        |



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HS

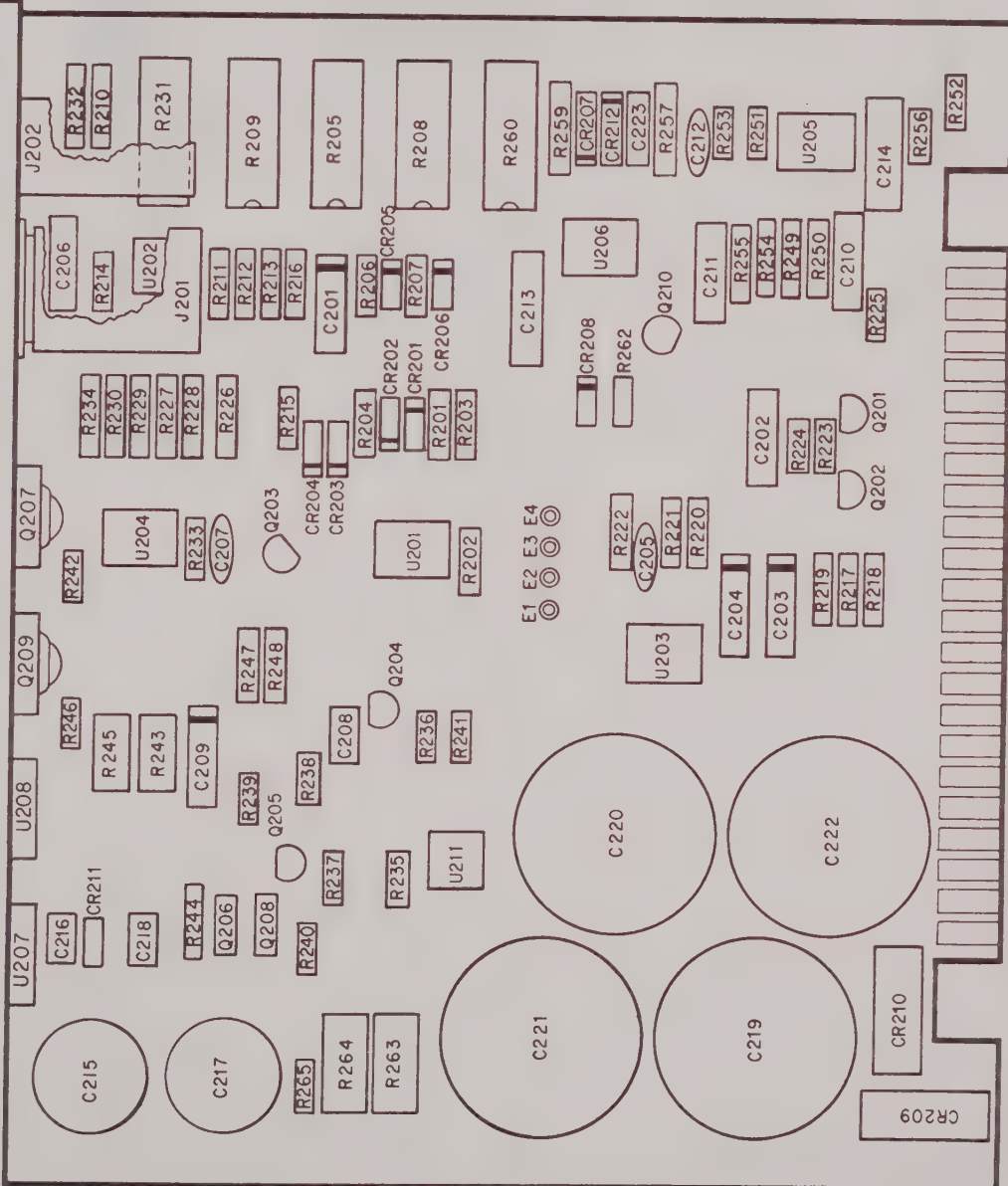


FIGURE 8-8 DRIVE AMPLIFIER BOARD ASSEMBLY



EXPLODED VIEW PARTS LIST  
 2400 SERIES RECORDER — All Models  
 BRACKET ASSEMBLY, SHIELD  
 FIGURE 8-9

| ITEM NO | PART NUMBER  | DESCRIPTION                          | SYMBOL NO | USED ON        |
|---------|--------------|--------------------------------------|-----------|----------------|
|         | 886667       | Bracket Assy, Shield                 |           | 60Hz Models    |
|         | 886921       | Bracket Assy, Shield                 |           | 50Hz Models    |
|         | 887098       | Bracket Assy, Shield                 |           | 400Hz Models   |
| 1       | 263394-1     | Clamp, Capacitor                     |           |                |
| 2       | 1-263395-405 | Capacitor, 4 $\mu$ fd                | C-106     | 60Hz Models    |
|         | 1-263395-505 | Capacitor, 5 $\mu$ fd                | C-106     | 50Hz Models    |
|         | 1-263395-205 | Capacitor, 2 $\mu$ fd                | C-106     | 400Hz Models   |
| 3       | 2-128693-1   | Grommet, Catapillar                  |           |                |
| 4       | 386029       | Bracket, Shield                      |           | 50/60Hz Models |
|         | 387227       | Bracket, Shield                      |           | 400Hz Models   |
| 5       | 265814-15    | Terminal Board, Q.D.                 | TB-103    |                |
| 6       | 281852-563   | Capacitor, .056 $\mu$ fd (Not Shown) | C-107     | 400Hz Models   |
| 7       | 234623-16    | Clamp (Not Shown)                    |           | 400Hz Models   |
| 8       | 265814-3     | Terminal Board (Not Shown)           | TB-105    | 400Hz Models   |



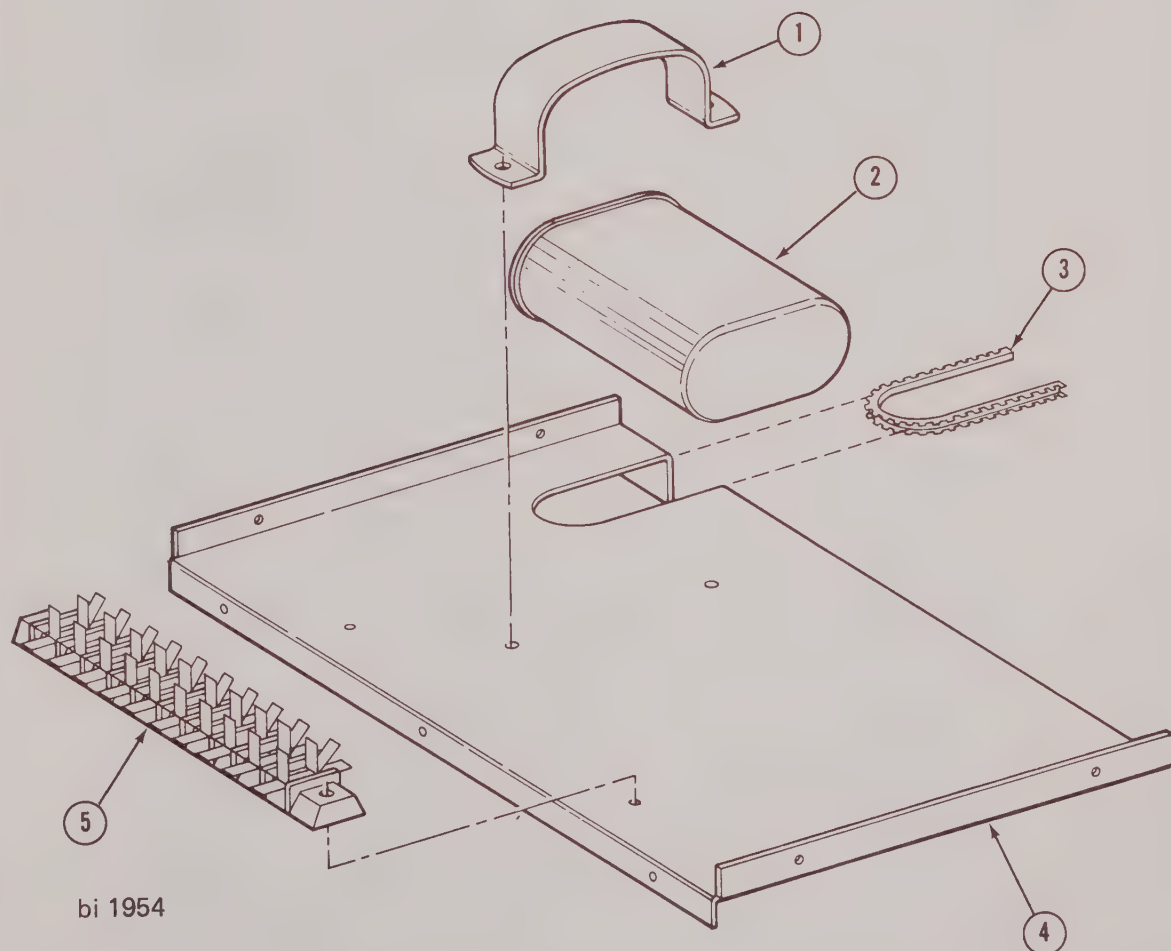


FIGURE 8-9 BRACKET ASSEMBLY, SHIELD



EXPLODED VIEW PARTS LIST  
2400 SERIES RECORDER – All Models  
BAR ASSEMBLIES, PENMOTOR – 250mm MAINFRAME  
FIGURE 8-10

PARTS IDENTIFICATION

| ITEM<br>NUMBER | PART<br>NUMBER | DESCRIPTION                     | SYMBOL<br>NUMBER | USED<br>ON |
|----------------|----------------|---------------------------------|------------------|------------|
|                | 785171         | *Bar Assy, Penmotor - 2 Channel |                  | 250-2      |
|                | 785175         | *Bar Assy, Penmotor - 3 Channel |                  | 250-3      |
|                | 785169         | *Bar Assy, Penmotor - 4 Channel |                  | 250-4      |
| 1              | 884320         | Penmotor Assembly               | M-101-104        |            |
| 2              | 287184         | Shield                          |                  | 250-3&4    |
| 3              | 2-128693-1     | Grommet                         |                  |            |
| 4              | 385704         | Bar, Penmotor                   |                  |            |
| 5              | 684853         | Saddle, Penmotor                |                  |            |
| 6              | 384597         | Stop<br>(A-P)                   |                  |            |
|                | 31-119918-4008 | Screw                           |                  |            |
|                | 1-118195-304   | Washer                          |                  |            |
|                |                | ----- * -----                   |                  |            |
| 7              | 684896         | Band Clamp, Rear<br>(A-P)       |                  |            |
|                | 265424-09010   | Screw                           |                  |            |
|                |                | ----- * -----                   |                  |            |
| 8              | 285273         | Anchor, Band                    |                  |            |
| 9              | 684999         | Band, Drive                     |                  |            |
| 10             | 284993         | Bracket, Pen<br>(A-P)           |                  |            |
|                | 31-119914-0004 | Screw                           |                  |            |
|                | 241073-0803    | Set Screw (Pen Adjust)          |                  |            |
|                |                | ----- * -----                   |                  |            |
| 11             | 784583         | Drive Arm Assembly<br>(A-P)     |                  |            |
|                | 31-119922-2608 | Screw                           |                  |            |
|                | 31-119998-26   | Nut, Hex                        |                  |            |
|                |                | ----- * -----                   |                  |            |
| 12             | 684896         | Band Clamp, Extrusion<br>(A-P)  |                  |            |
|                | 265424-09008   | Screw                           |                  |            |
|                |                | ----- * -----                   |                  |            |
| 13             | 284924         | Plate, Nut                      |                  |            |

\*Penmotor Bar Assemblies not procurable, use item 1 thru 13 and attaching parts, (A-P).



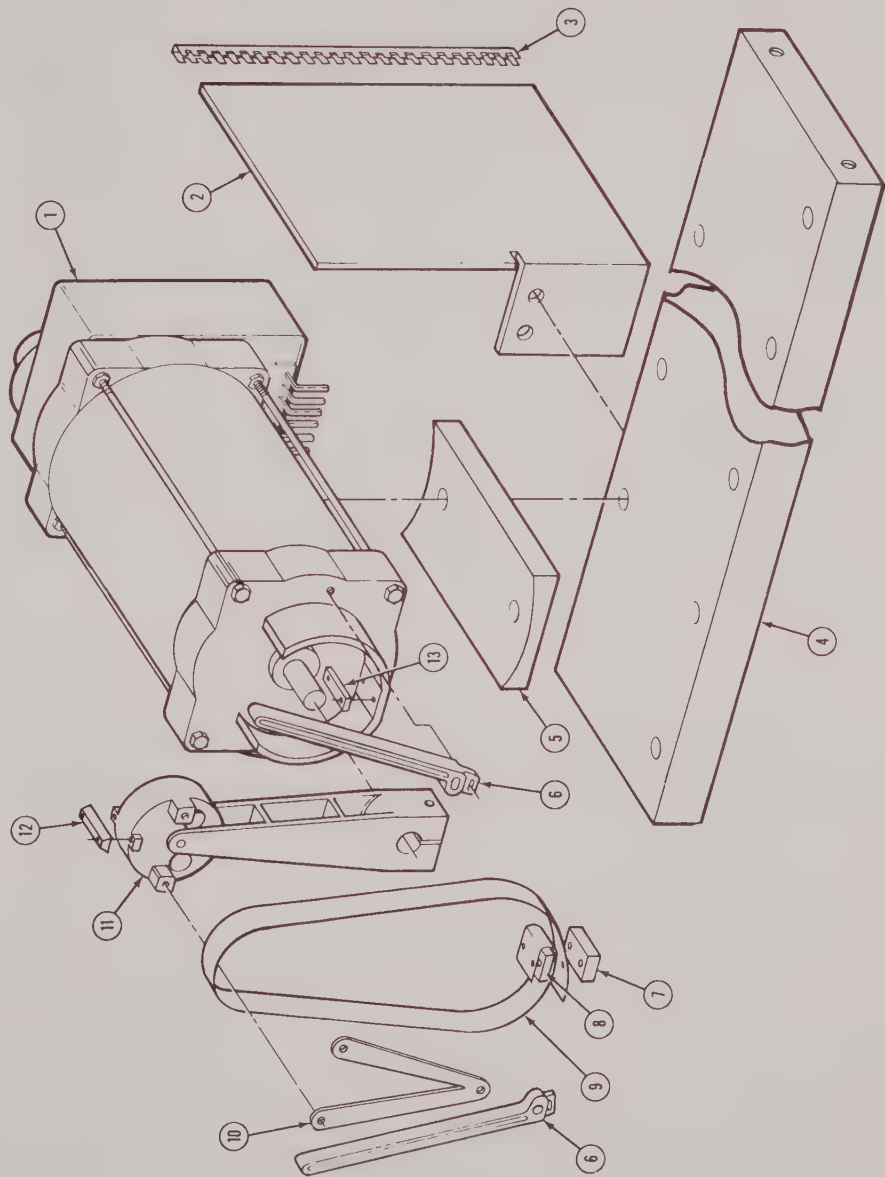


FIGURE 8-10 BAR ASSEMBLY, PENMOTOR



## EXPLODED VIEW PARTS LIST

2400 SERIES RECORDER — All Models

\*INTERCHANNEL EVENT MARKER—11-2123-35(Including Harness)

FIGURE 8-11

| ITEM<br>NO | PART<br>NUMBER | DESCRIPTION                                   | SYMBOL<br>NO       | USED<br>ON |
|------------|----------------|-----------------------------------------------|--------------------|------------|
| 1          | 887181         | Interchannel Event Marker Assy (less harness) |                    |            |
| 2          | 286619         | Nut, Plate                                    |                    |            |
| 3          | Not Used       |                                               |                    |            |
| 4          | 786658         | Bracket Assy                                  |                    |            |
| 5          | 270153-1       | Contact                                       |                    |            |
| 5          | 9-270158-2     | Connector, Plug                               | J-105 thru J-109   |            |
| 6          | 269256-7       | Diode                                         |                    |            |
| 7          | 3-227070-2     | Ring, Retaining                               | CR-114 thru CR-118 |            |
| 8          | 385930         | Pivot, Pen                                    |                    |            |
| 9          | 286416         | Spring, Helical                               |                    |            |
| 10         | 249249-14      | Pin                                           |                    |            |
| 11         | 260742-1       | Washer, Flat                                  |                    |            |
| 12         | 286415         | Solenoid                                      | L-108 thru L-112   |            |
| 13         | 267884-5       | Tube, Pen                                     |                    |            |
| 14         | 241073-0803    | Screw, Set                                    |                    |            |
| 15         | 285166         | Bracket, Pen Pressure                         |                    |            |

\* Model 11-2133-35 includes harness for 3 event markers plus one interchannel event marker (887181).



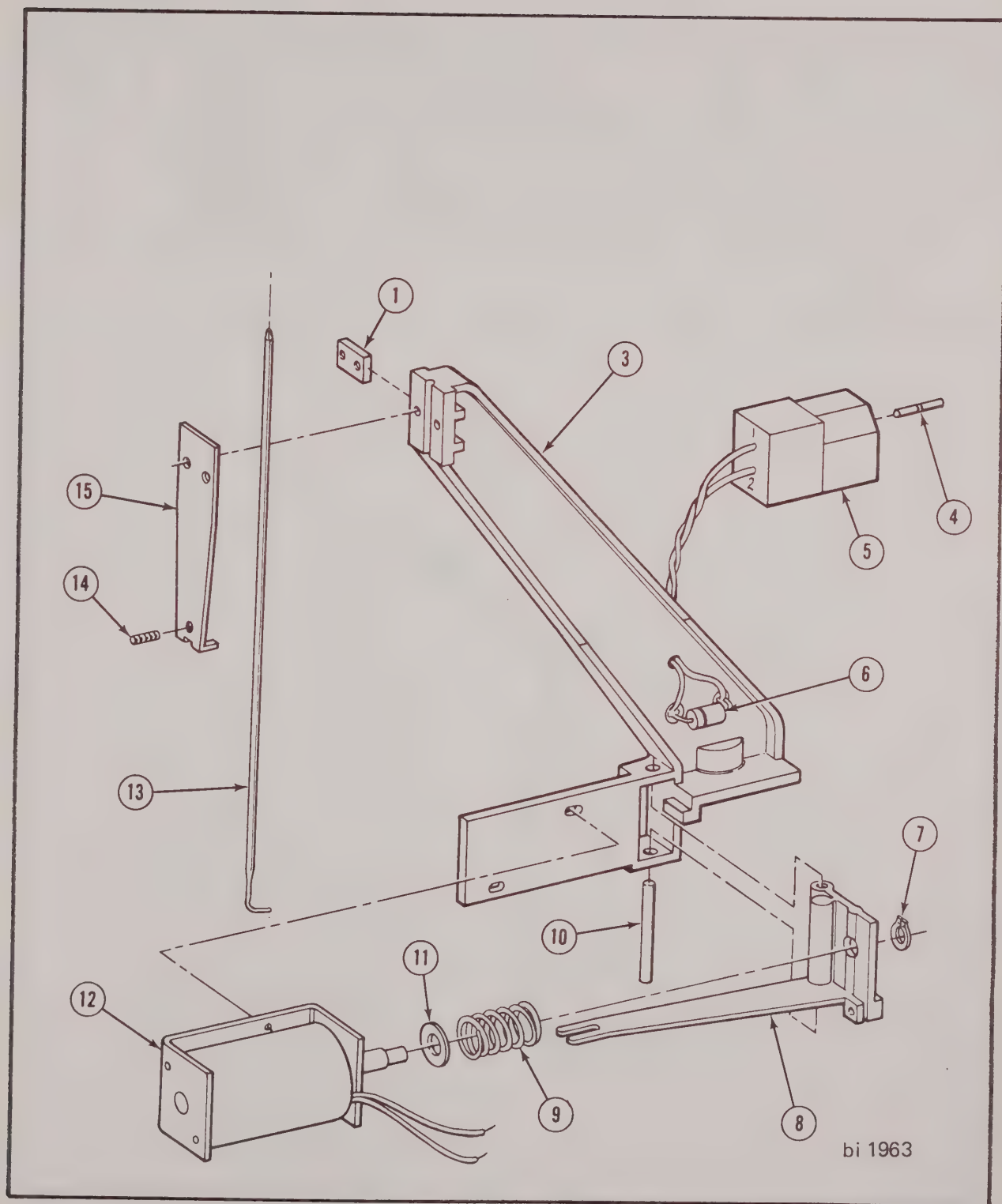


FIGURE 8-11 INTERCHANNEL EVENT MARKER



EXPLODED VIEW PARTS LIST  
2400 SERIES RECORDER —All Models  
BRAKE ASSEMBLY 683485  
FIGURE 8-12

| ITEM NO | PART NUMBER | DESCRIPTION             | SYMBOL NO | USED ON |
|---------|-------------|-------------------------|-----------|---------|
| 1       | 685127      | Disk Assy               |           |         |
| 2       | 269291      | Spring                  |           |         |
| 3       | 0-108400-15 | Insulation, Flex Sleeve |           |         |
| 4       | 743913-10   | Arm Subassy             |           |         |
| 5       | 0-240731-2  | Ring, Retaining         |           |         |

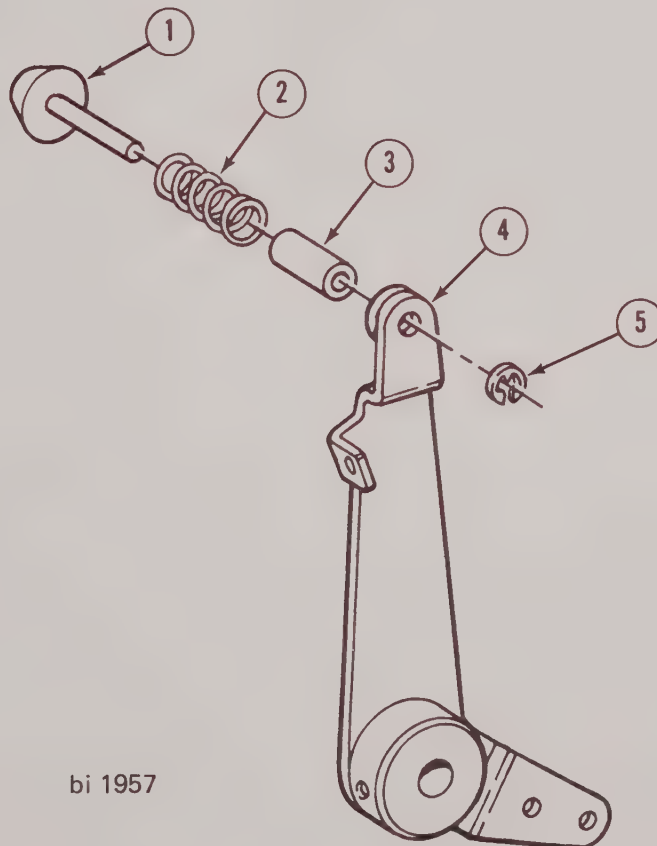


FIGURE 8-12 BRAKE ASSEMBLY



EXPLODED VIEW PARTS LIST  
 2400 SERIES RECORDER – All Models  
 PLATE ASSEMBLY, R.H.  
 FIGURE 8-13

| ITEM<br>NUMBER | PART<br>NUMBER | DESCRIPTION          | USED<br>ON |
|----------------|----------------|----------------------|------------|
|                | 885083         | Plate Assembly, R.H. | 250-3 & 4  |
|                | 885083-6       | Plate Assembly, R.H. | 250-2      |
| 1              | 385543-1       | Guide                |            |
| **2            | 886560         | Plate Subassy        | 250-3 & 4  |
|                | 886560-5       | Plate Subassembly    | 250-2      |
| 3              | 286130         | Bracket, Connector   |            |
| 4              | 286186         | Shaft                |            |
| 5              | 286184         | Shaft                |            |
| 6              | 285712         | Bracket, R.H.        |            |
| 7              | 265711         | Catch                |            |
| 8              | 1-227070-9     | Ring, Retaining      |            |
| 9              | 127271         | Washer               |            |
| 10             | 243898-62      | Nut Assy             |            |
| 11             | 243622         | Pad, Friction        |            |
| 12             | 243623         | Spring               |            |
| 13             | 665789         | Lever Assy, R.H.     |            |
| 14             | 285599         | Catch                |            |
| 15             | 1-265849-4     | Bracket              |            |

\*\*Items 4, 5 & 7 part of item 2.



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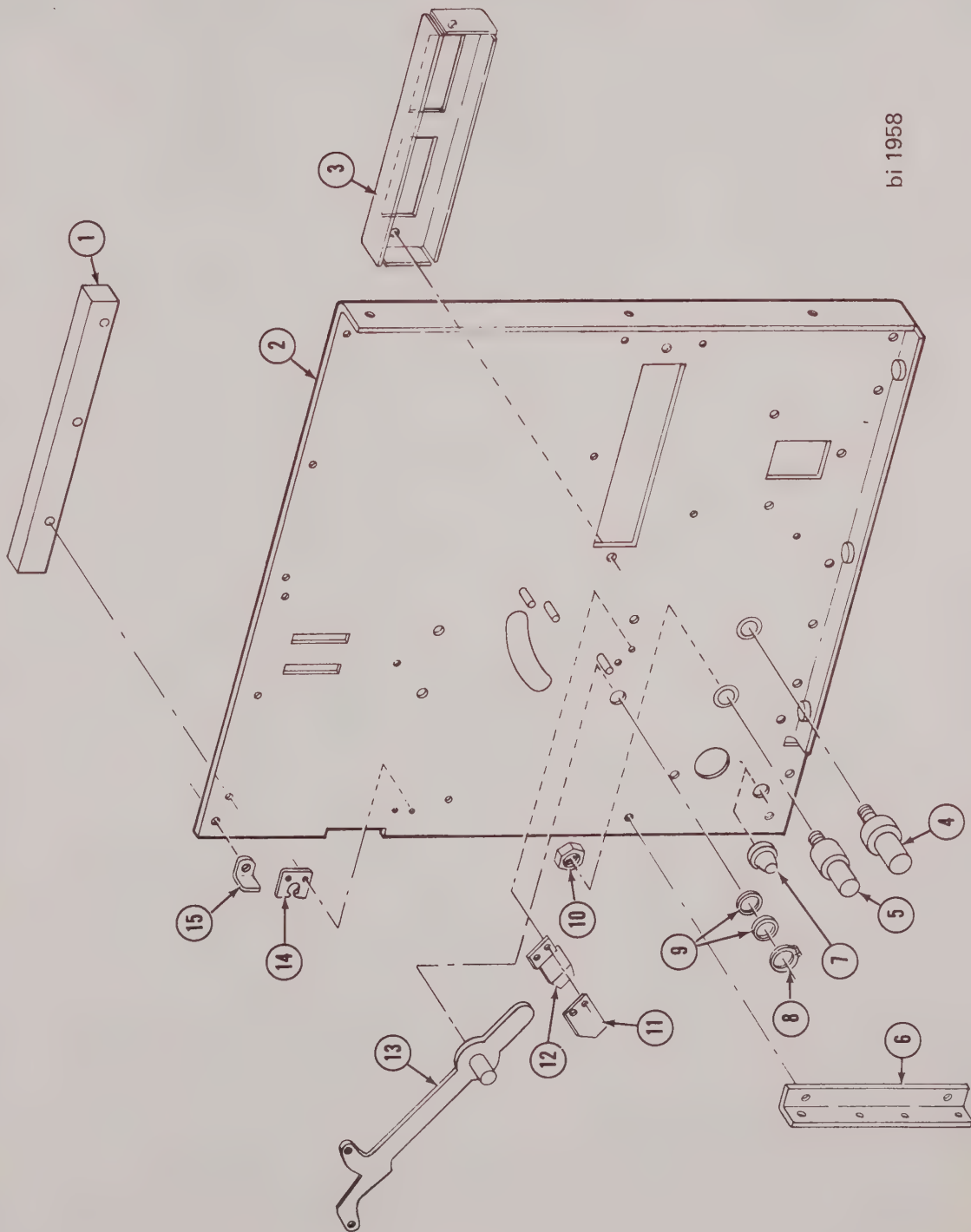


FIGURE 8-13 R.H. PLATE ASSEMBLY



EXPLODED VIEW PARTS LIST  
 2400 SERIES RECORDER — All Models  
 SENSOR ASSEMBLY  
 FIGURE 8-14

| ITEM NO | PART NUMBER | DESCRIPTION       | SYMBOL NO | USED ON |
|---------|-------------|-------------------|-----------|---------|
| 1       | 783590      | Sensor Assembly   | S-102     |         |
| 2       | 286154      | Switch, Sensitive |           |         |
| 3       | 286386      | Arm Switch        |           |         |
| 4       | 743915      | Arm Assy, Sensor  |           |         |
| 5       | 286385      | Spring, Torsion   |           |         |
|         | 286384      | Pin               |           |         |

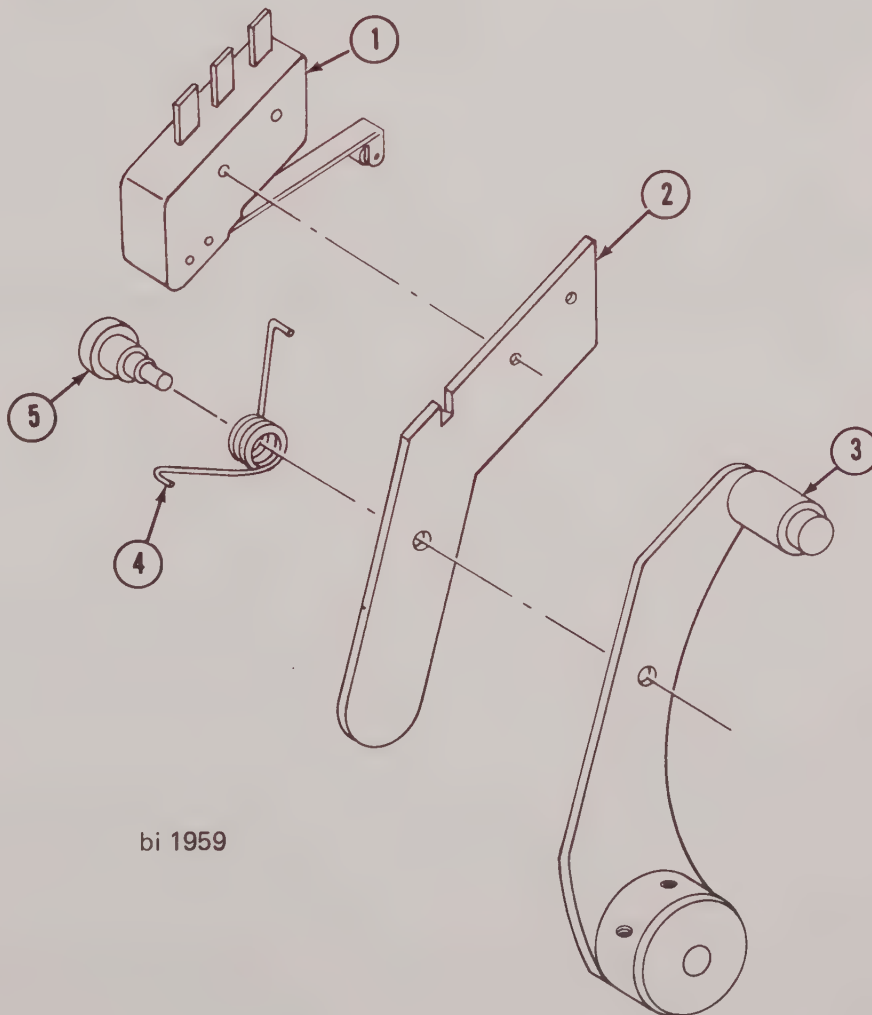


FIGURE 8-14 SENSOR ASSEMBLY



EXPLODED VIEW PARTS LIST  
 2400 SERIES RECORDER — ALL MODELS  
 \*CHASSIS ASSEMBLIES — 250 MM MAINFRAME (See Table 8-2)  
 FIGURE 8-15

| ITEM<br>NUMBER | PART<br>NUMBER | DESCRIPTION                                 | SYMBOL<br>NUMBER | USED<br>ON |
|----------------|----------------|---------------------------------------------|------------------|------------|
| *1             | 785129         | Drive Assy, 115V/60Hz — 100 (See Fig. 8-16) |                  |            |
|                | 785129-1       | Drive Assy, 115V/60Hz — 60 (See Fig. 8-16)  |                  |            |
|                | 786837         | Drive Assy, 115V/50Hz — 100 (See Fig. 8-16) |                  |            |
|                | 786837-1       | Drive Assy, 115V/50Hz — 60 (See Fig. 8-16)  |                  |            |
|                | 786886         | Drive Assy, 230V/50Hz — 100 (See Fig. 8-16) |                  |            |
|                | 786886-1       | Drive Assy, 230V/50Hz — 60 (See Fig. 8-16)  |                  |            |
| 2              | 265814-4       | Board, Terminal                             | TB-104           |            |
| 3              | 286484         | Bracket                                     |                  |            |
| 4              | 486072         | Chassis                                     |                  |            |
| 5              | 286026         | Transformer, Power                          | T-101 thru T-104 |            |
| 6              | 286024         | Transformer, Control                        | T-109            |            |

\*Chassis Assemblies and Drive Assemblies are not procurable. For Chassis parts order from items 2 thru 6 on this page, and for drive assy parts refer to Figure 8-16 parts list.



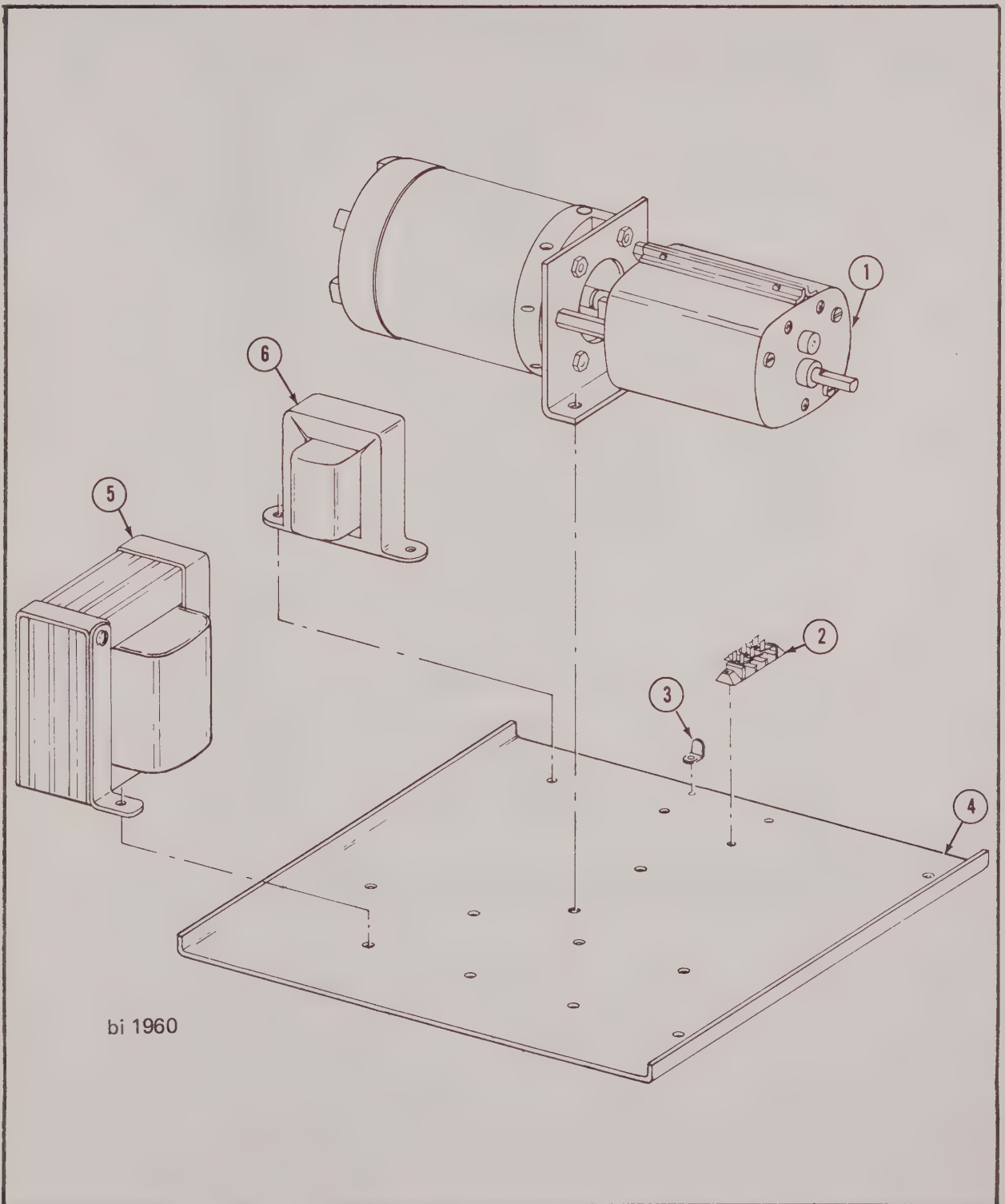


FIGURE 8-15 CHASSIS ASSEMBLY



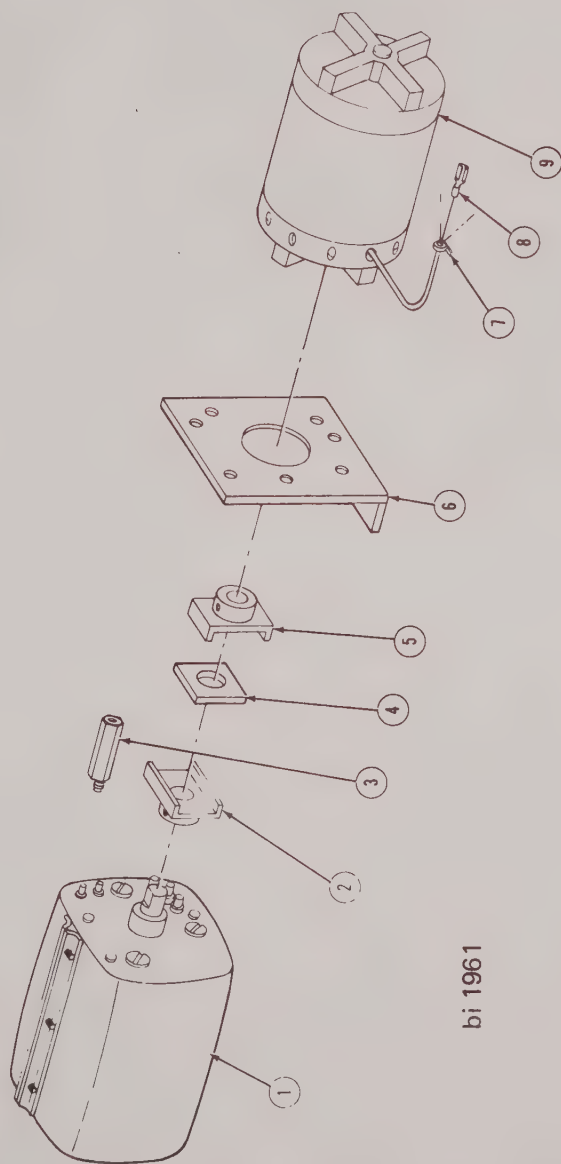
EXPLODED VIEW PARTS LIST  
 2400 SERIES RECORDER — All Models  
 DRIVE ASSEMBLIES — 250 mm MAINFRAME  
 FIGURE 8-16

| ITEM NO | PART NUMBER  | DESCRIPTION                                             | SYMBOL NO | USED ON |
|---------|--------------|---------------------------------------------------------|-----------|---------|
|         | *785129      | Drive Assembly                                          |           |         |
|         | *785129-1    | Drive Assembly                                          |           |         |
|         | *786837      | Drive Assembly                                          |           |         |
|         | *786837-1    | Drive Assembly                                          |           |         |
|         | *786886      | Drive Assembly                                          |           |         |
|         | *786886-1    | Drive Assembly                                          |           |         |
|         | **12-2202-16 | Transmission & Motor Assy<br>(115V/400Hz, ÷ 100 Models) |           |         |
|         | **12-2203-16 | Transmission & Motor Assy<br>(115V/400Hz, ÷ 60 Models)  |           |         |
| 1       | 12-2158-16   | Transmission Assy — 16SPD<br>(60Hz, ÷ 100 Models)       | A-111     |         |
|         | 12-2160-16   | Transmission Assy — 16SPD<br>(60Hz, ÷ 60 Models)        | A-111     |         |
|         | 12-2159-16   | Transmission Assy — 16SPD<br>(50Hz, ÷ 100 Models)       | A-111     |         |
|         | 12-2161-16   | Transmission Assy — 16SPD<br>(50Hz, ÷ 60 Models)        | A-111     |         |
| 2       | 127913       | Coupling, Universal                                     |           |         |
| 3       | 127911       | Post                                                    |           |         |
| 4       | 123695       | Core, Coupling                                          |           |         |
| 5       | 127912       | Coupling, Universal                                     |           |         |
| 6       | 385617       | Bracket, Motor Mounting                                 |           |         |
| 7       | 232997-23    | Strap, Retaining                                        |           |         |
| 8       | 265840-2     | Terminal Lug                                            |           |         |
| 9       | 387919       | Motor, 115V/60Hz                                        | B-101     |         |
|         | 287170       | Motor, 115V/50Hz                                        | B-101     |         |
|         | 267590       | Motor, 230V/50Hz                                        | B-101     |         |

\*Drive assemblies are not procurable. Order desired parts from itemized list on this page.

\*\*This model not exploded.





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FIGURE 8-16 DRIVE ASSEMBLY



EXPLODED VIEW PARTS LIST  
2400 SERIES RECORDER — All Models  
TABLE ASSEMBLY, WRITING  
FIGURE 8-17

| ITEM<br>NO | PART<br>NUMBER | DESCRIPTION             |
|------------|----------------|-------------------------|
|            | 885748         | Table Assembly, Writing |
| 1          | 785703         | Bar Assy, Writing       |
| 2          | 785746         | Paper Release Assy      |
| 3          | 343616-910     | Support Assy, Right     |
| 4          | 4-112468-21    | Roll Pin                |
| 5          | 1-210761-6     | Bearing, Ball           |
| 6          | 285618         | Roll, Pressure          |
| 7          | 685620         | Bar Subassy, Pull       |
| 8          | 243867-1       | Packing, Preformed      |
| 9          | 343617-910     | Support Assy, Left      |



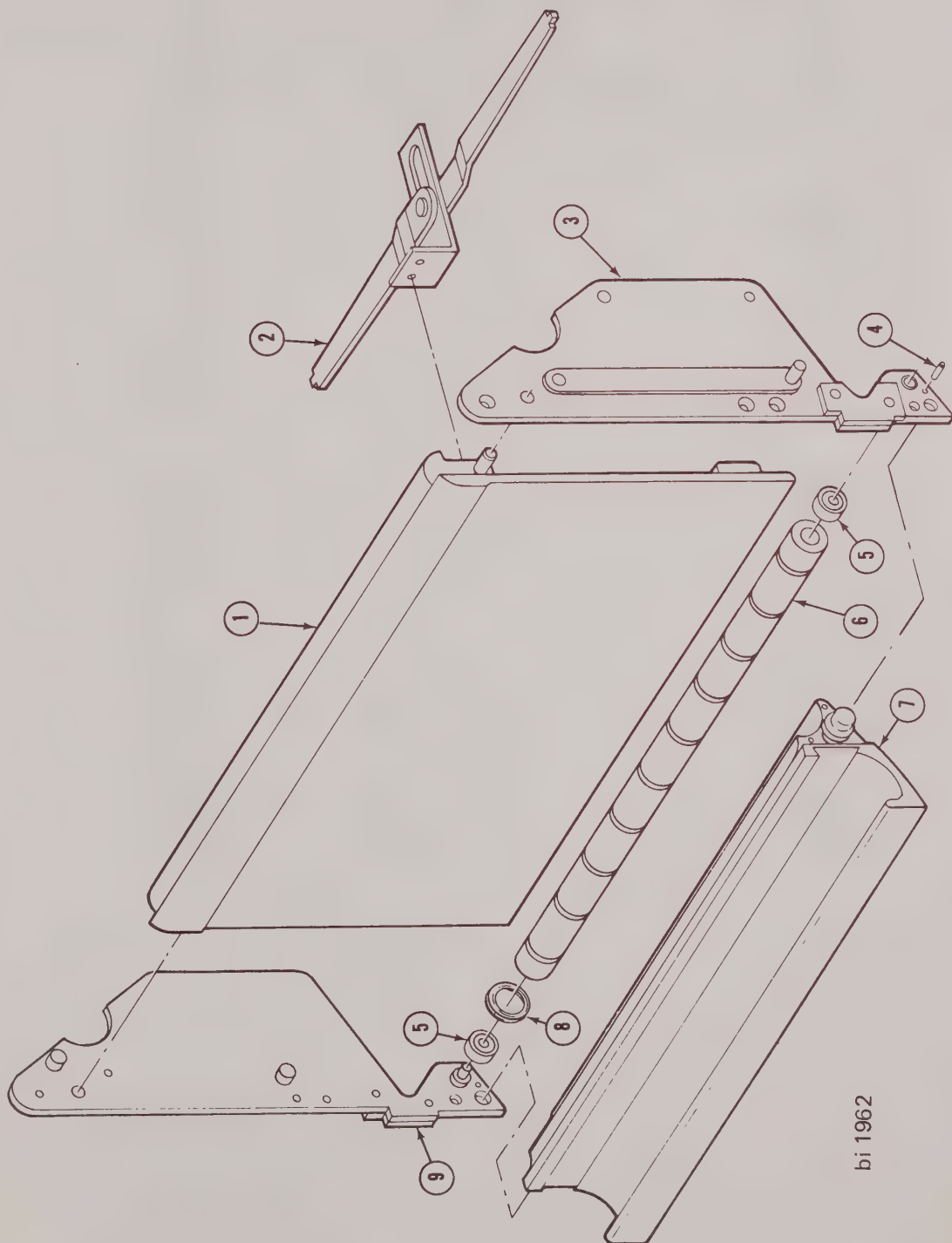


FIGURE 8-17 TABLE ASSEMBLY, WRITING



EXPLODED VIEW PARTS LIST  
 2400 SERIES RECORDER — All Portable Models  
 CASE ASSEMBLY 2, 3 & 4 CHANNEL  
 FIGURE 8-18

| ITEM NO | PART NUMBER | DESCRIPTION                        | USED ON          |
|---------|-------------|------------------------------------|------------------|
|         | 886569      | Case Assembly (w/o Preamps)        | 250-2, 3 & 4     |
|         | 886492      | Case Assembly (w/2 Ch Preamp Cage) | 250-2P           |
|         | 886399      | Case Assembly (w/4 Ch Preamp Cage) | 250-3P & 4P      |
| 1       | 486081      | Panel                              |                  |
| 2       | 785099-3    | Handle Assy                        | 250-2, 3 & 4     |
|         | 785099-2    | Handle Assy                        | 250-2P           |
|         | 785099-1    | Handle Assy                        | 250-3P & 4P      |
| 3       | 686049-3    | Cover, Center                      | 250-2, 3 & 4     |
|         | 686049-2    | Cover, Center                      | 250-2P           |
|         | 686049-1    | Cover, Center                      | 250-3P & 4P      |
| 4       | 286048      | Support, Handle                    |                  |
| 5       | 486075-2    | Guide, Left                        |                  |
| 6       | 486075-1    | Guide, Right                       |                  |
| 7       | 686051-3    | Cover, Front & Rear                | 250-2, 3 & 4     |
|         | 686051-2    | Cover, Front & Rear                | 250-2P           |
|         | 686051-1    | Cover, Front & Rear                | 250-3P & 4P      |
| 8       | 1-232736-16 | Tape, Teflon                       |                  |
| 9       | 4-266107-5  | Bail Assy                          | 250-2, 3, 4 & 2P |
|         | 267451-5    | Bail Assy                          | 250-3P & 4P      |
| 10      | 485177      | Saddle, Recorder                   | 250-2, 3 & 4     |
|         | 886474      | Saddle, Recorder                   | 250-2P           |
|         | 886060      | Saddle, Recorder                   | 250-3P & 4P      |
| 11      | 287185      | Bar, Support                       |                  |
| 12      | 292817-1    | Spacer                             | 250-2P           |
|         | 292817-2    | Spacer                             | 250-3P & 4P      |



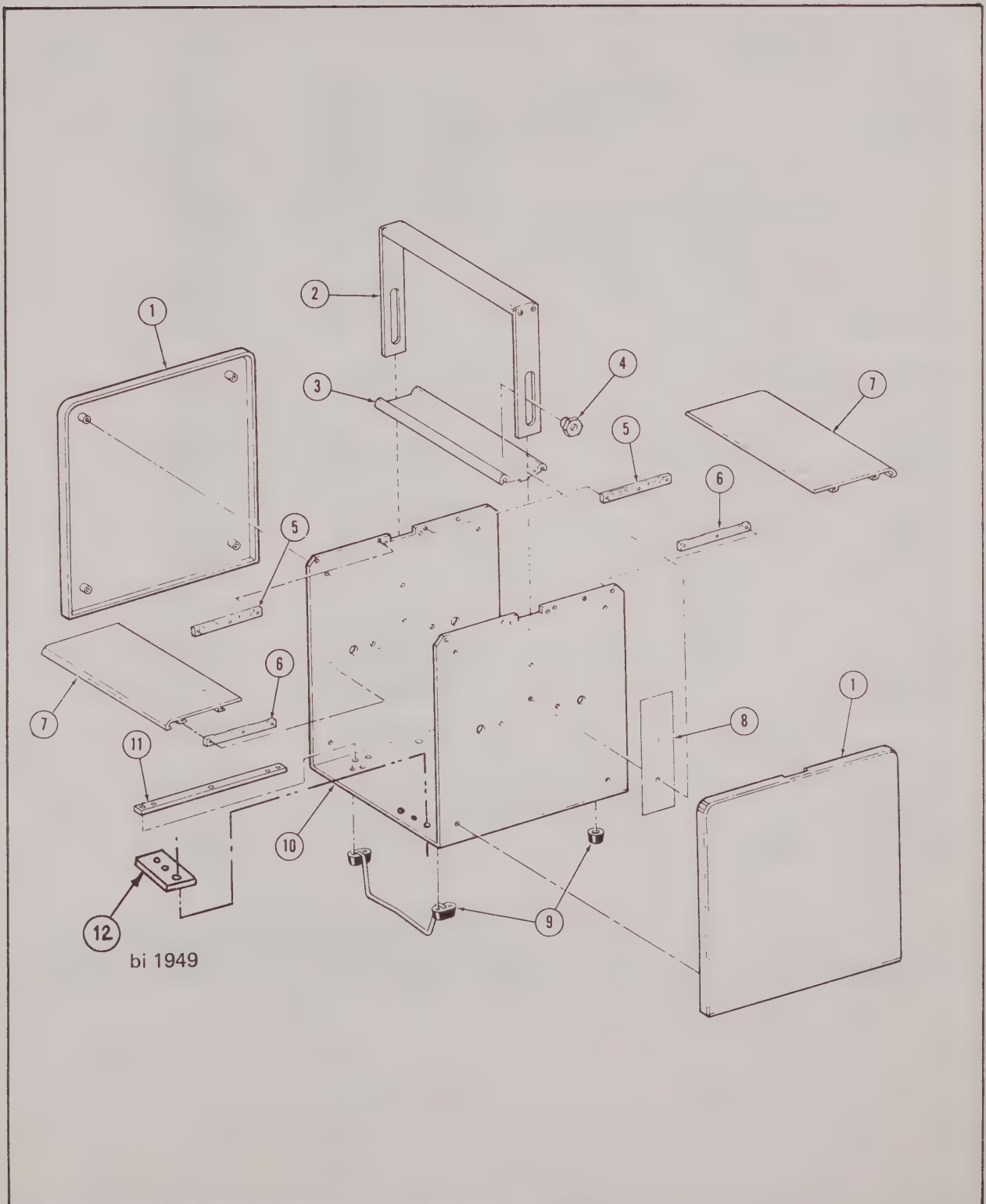


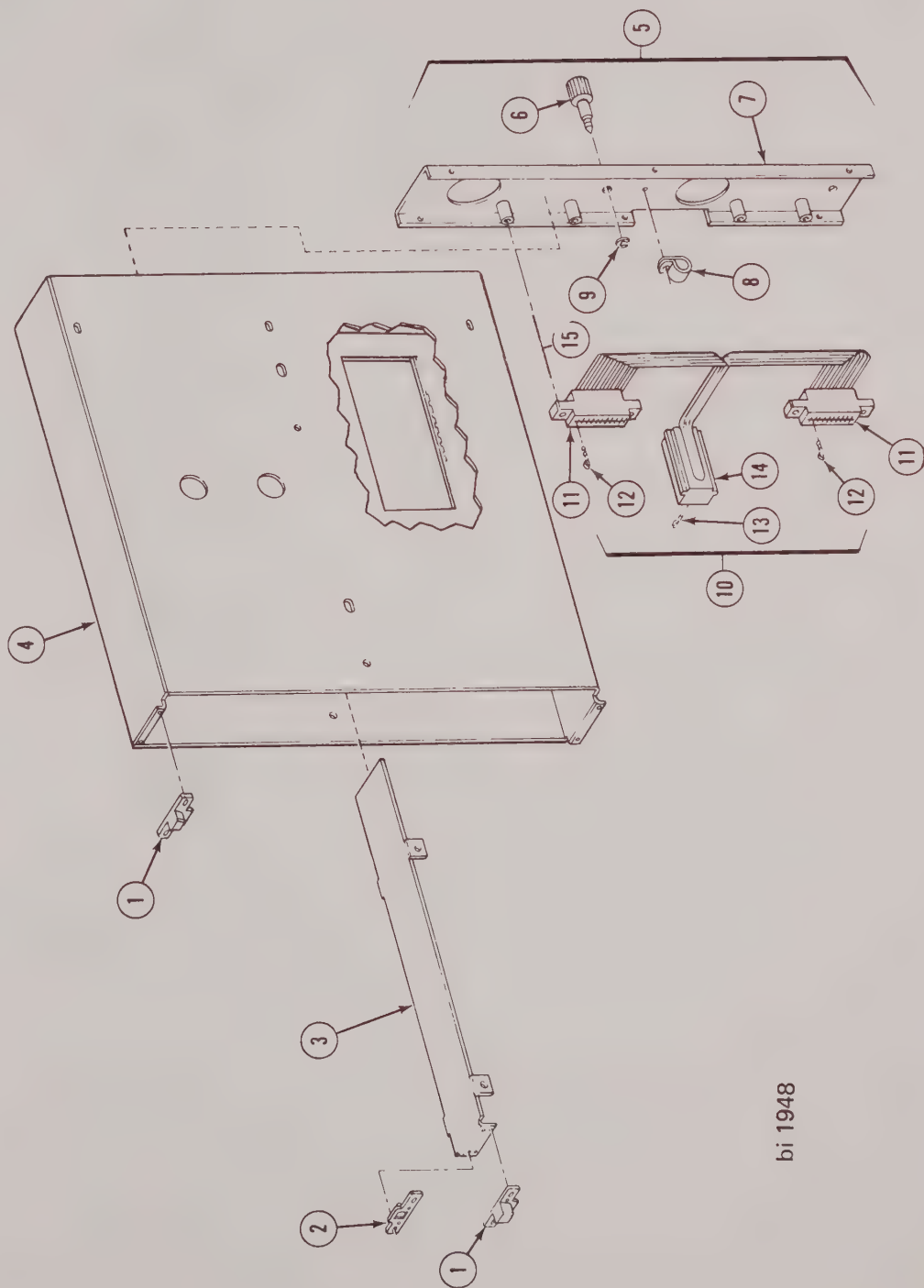
FIGURE 8-18 CASE ASSEMBLY



EXPLODED VIEW PARTS LIST  
 2400 SERIES RECORDER — ALL MODELS  
 CAGE ASSEMBLY, PREAMP  
 FIGURE 8-19

| ITEM<br>NUMBER                                                                                                        | PART<br>NUMBER | DESCRIPTION                       | SYMBOL<br>NUMBER        | USED<br>ON  |
|-----------------------------------------------------------------------------------------------------------------------|----------------|-----------------------------------|-------------------------|-------------|
| 1                                                                                                                     | 888321         | Cage Assy, Preamp, 2 Channel      |                         | 250-2P      |
|                                                                                                                       | 886400         | Cage Assy, Preamp, 3 & 4 Channel  |                         | 250-3P & 4P |
|                                                                                                                       | **886494       | Cage Assy, Preamp                 |                         | **          |
|                                                                                                                       | 786056-1       | Guide, Engraved "1"               |                         |             |
|                                                                                                                       | 786056-2       | Guide, Engraved "2"               |                         |             |
|                                                                                                                       | 786056-3       | Guide, Engraved "3"               |                         |             |
|                                                                                                                       | 786056-4       | Guide, Engraved "4"               |                         |             |
| 2                                                                                                                     | 386058-2       | Guide, Preamp                     |                         | 250-2P      |
| 3                                                                                                                     | 386476         | Shelf                             |                         | 250-3P & 4P |
|                                                                                                                       | 386059         | Shelf                             |                         |             |
| 4                                                                                                                     | 486461         | Enclosure, Preamp                 |                         | 250-2P      |
|                                                                                                                       | 486061         | Enclosure, Preamp                 |                         | 250-3P & 4P |
| *5                                                                                                                    | 788280         | Cage Assy- Rear                   |                         | 250-2P      |
|                                                                                                                       | 786567         | Cage Assy - Rear                  |                         | 250-3P & 4P |
| 6                                                                                                                     | 286052         | Screw, Shoulder                   |                         |             |
| 7                                                                                                                     | 786475         | Panel Assy, Rear                  |                         | 250-2P      |
|                                                                                                                       | 786055         | Panel Assy, Rear                  |                         | 250-3P & 4P |
| 8                                                                                                                     | 234623-6       | Clamp, Loop                       |                         |             |
| 9                                                                                                                     | 3-240731-10    | Ring, Retaining                   |                         |             |
| 10                                                                                                                    | 787422         | Harness Assy                      |                         | 250-2P      |
|                                                                                                                       | 885131-1       | Harness Assy                      |                         | 250-3P & 4P |
| 11                                                                                                                    | 286410-16      | Connector                         | XA-201, 202<br>203, 204 |             |
| 12                                                                                                                    | 1-283408-2     | Contact, Electrical (for item 11) |                         |             |
| 13                                                                                                                    | 270153-1       | Contact, Electrical (for item 14) |                         |             |
| 14                                                                                                                    | 0-270155-1     | Connector                         | P-203                   | 250-3P & 4P |
|                                                                                                                       | 9-270158-15    | Connector                         | P-203                   | 250-2P      |
| *Item 5, Cage Assemblies-Rear, not available. Use idented items<br>6 thru 14 or appropriate Cage Assy at top of list. |                |                                   |                         |             |
| **Used with 3 Channel Recorder and 2 Channel Preamp Cage.                                                             |                |                                   |                         |             |





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FIGURE 8-19 CAGE ASSEMBLY



## EXPLODED VIEW PARTS LIST

## 2400 SERIES RECORDERS

## RACK MOUNT INSTALLATION INSTRUCTIONS – RECORDER ONLY (687330)

## FIGURE 8-20

| ITEM NO | PART NUMBER    | DESCRIPTION                                        |
|---------|----------------|----------------------------------------------------|
| 1       | 2007-4X90-XX   | Recorder Assy                                      |
| 2       | 31-119998-02   | Nut                                                |
| 3       | 1-216741-430   | Lockwasher                                         |
| 4       | 287011         | Bracket                                            |
| 5       | 31-119918-0208 | Screw                                              |
| 6       | 31-119998-82   | Nut                                                |
| 7       | 1-216741-425   | Lockwasher                                         |
| 8       | 269569-1       | Slides, Pair                                       |
| 9       | 287148         | Nut Plate                                          |
| 10      | 31-119918-8206 | Screw                                              |
| 11      | 287153         | Spacer                                             |
| 12      | 31-119920-0208 | Screw                                              |
| 13      | 887154         | Saddle Assy                                        |
| 14      | 13-262716-4004 | Screw                                              |
| 15      | 387145         | Bracket                                            |
| 16      | 787144         | Panel Assy, Front                                  |
| 17      | 248352-0218    | Screw                                              |
| 18      | 245244-02      | Nut                                                |
| 19      | 11-1202-11     | Kit Assy, Rack (includes items 2 thru 18 plus 20). |
| 20      | 287653         | Spring, Rack Lock                                  |
|         | 269569-2       | * Front Bracket (Part of item 8)                   |
|         | 269569-3       | * Rear Bracket (Part of item 8)                    |
|         | 269569-4       | * Nut Bar (Part of item 8)                         |

\* Order Separately



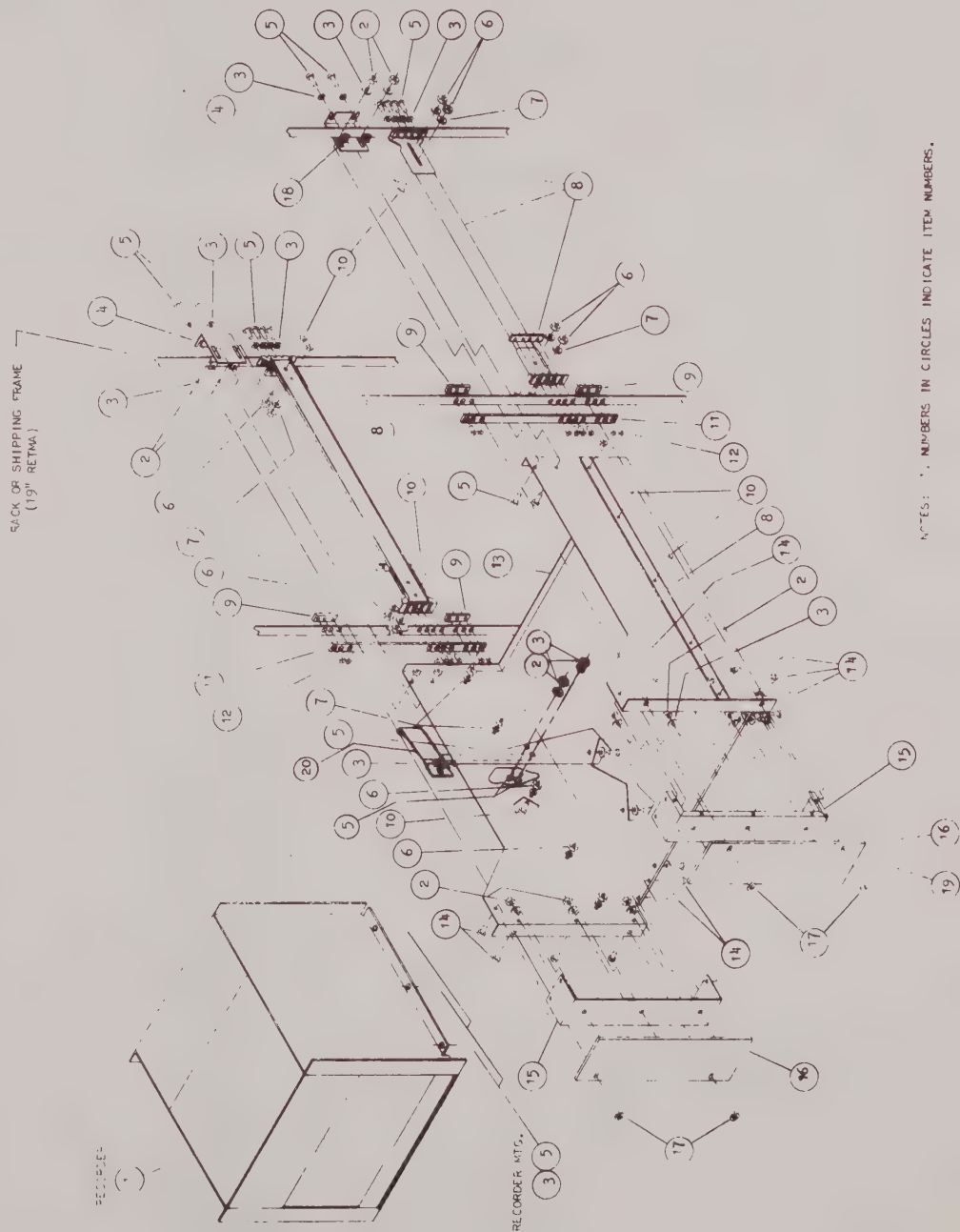


FIGURE 8-20 RACK MOUNT INSTALLATION INSTRUCTIONS - RECORDER ONLY (687330)



## EXPLODED VIEW PARTS LIST

## 2400 SERIES RECORDER

RACK MOUNT INSTALLATION INSTRUCTIONS — Recorder with 2 Channel Preamp Cage (687363)

FIGURE 8-21

| ITEM NO | PART NUMBER    | DESCRIPTION                                                         |
|---------|----------------|---------------------------------------------------------------------|
| 1       | 2007-4290-XX   | Recorder Assy                                                       |
| 2       | 13-262715-4004 | Screw                                                               |
| 3       | 1-118195-305   | Washer                                                              |
| 4       | 13-262716-4004 | Screw                                                               |
| 5       | 10-120053-101  | Lockwasher                                                          |
| 6       | 293035         | Bracket, Support                                                    |
| 7       | 888321         | Cage Assy                                                           |
| 8       | 31-119918-8204 | Screw                                                               |
| 9       | 1-216741-425   | Lockwasher                                                          |
| 10      | 1-118195-307   | Washer                                                              |
| 11      | 13-262716-8204 | Screw                                                               |
| 12      | 10-120053-103  | Lockwasher                                                          |
| 13      | 1-216741-430   | Lockwasher                                                          |
| 14      | 31-119998-02   | Nut                                                                 |
| 15      | 31-119998-82   | Nut                                                                 |
| 16      | Not Used       |                                                                     |
| 17      | 31-119918-8206 | Screw                                                               |
| 18      | 287148         | Nut Plate                                                           |
| 19      | 287153         | Spacer                                                              |
| 20      | 31-119920-0208 | Screw                                                               |
| 21      | 269548-1       | Spacer                                                              |
| 22      | 31-119918-0208 | Screw                                                               |
| 23      | 887089         | Saddle Assy                                                         |
| 24      | 31-119918-6204 | Screw                                                               |
| 25      | 1-216741-420   | Lockwasher                                                          |
| 26      | 1-265849-4     | Bracket                                                             |
| 27      | 787146         | Panel Assy, Front                                                   |
| 28      | 248352-0218    | Screw                                                               |
| 29      | 245244-02      | Nut                                                                 |
| 30      | 287011         | Bracket                                                             |
| 31      | 11-1202-12     | Kit Assy, Rack (includes items 2 thru 6, 8 thru 30, plus 32 and 33) |
| 32      | 287653         | Spring, Rack Lock                                                   |
| 33      | 243898-82      | Nut, Assembled Lock                                                 |
| 34      | 269569-1       | Slides, Pair                                                        |
| 35      | 269569-2       | Front Bracket *                                                     |
| 36      | 269569-3       | Rear Bracket *                                                      |
| 37      | 269569-4       | Nut Bar *                                                           |

\* Order Separately



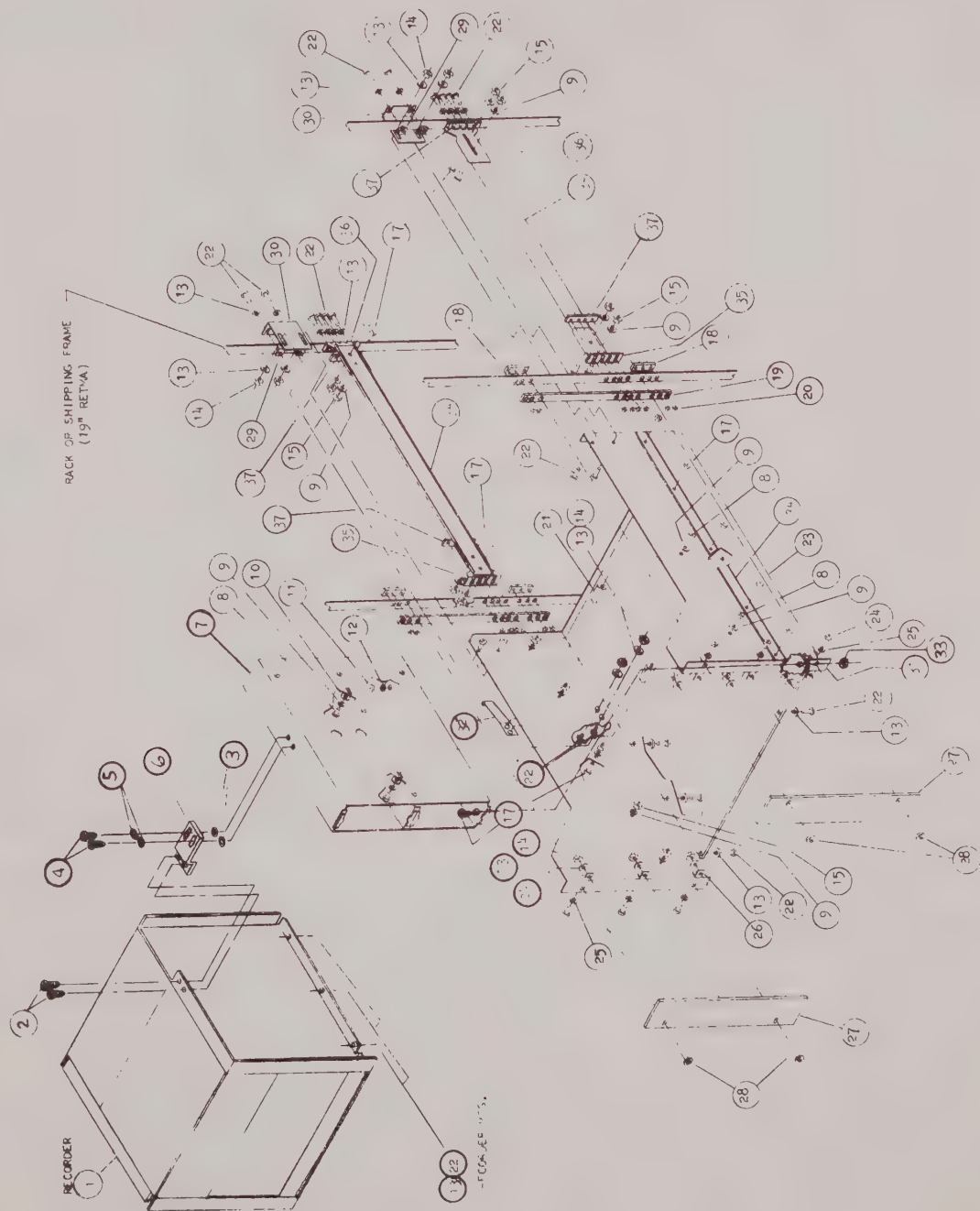


FIGURE 8-21 RACK MOUNT INSTALLATION INSTRUCTIONS - RECORDER WITH 2-CHANNEL PREAMP CAGE (687363)



## EXPLODED VIEW PARTS LIST

## 2400 SERIES RECORDER

## RACK MOUNT INSTALLATION INSTRUCTIONS – RECORDER with 4 Channel Preamp Cage (687361)

## FIGURE 8-22

| ITEM NO | PART NUMBER    | DESCRIPTION                                                      |
|---------|----------------|------------------------------------------------------------------|
| 1       | 2007-4X90-XX   | Recorder Assy                                                    |
| 2       | 13-262715-4004 | Screw                                                            |
| 3       | 1-118195-305   | Washer                                                           |
| 4       | 13-262716-4004 | Screw                                                            |
| 5       | 10-120053-101  | Lockwasher                                                       |
| 6       | 293034         | Bracket, Support                                                 |
| 7       | 886400         | Cage Assy                                                        |
| 8       | 13-262716-8204 | Screw                                                            |
| 9       | 1-216741-425   | Lockwasher                                                       |
| 10      | 1-118195-307   | Washer                                                           |
| 11      | 10-120053-103  | Lockwasher                                                       |
| 12      | 245244-02      | Nut                                                              |
| 13      | 31-119998-02   | Nut                                                              |
| 14      | 1-216741-430   | Lockwasher                                                       |
| 15      | 287011         | Bracket                                                          |
| 16      | 31-119918-0208 | Screw                                                            |
| 17      | 31-119998-82   | Nut                                                              |
| 18      | 32-119918-8206 | Screw                                                            |
| 19      | 887063         | Saddle Assy                                                      |
| 20      | 269569-3       | Rear Bracket                                                     |
| 21      | 269569-4       | Bar Nut                                                          |
| 22      | 269569-2       | Front Bracket                                                    |
| 23      | 287148         | Nut Plate                                                        |
| 24      | 287153         | Spacer                                                           |
| 25      | 31-119920-0208 | Screw                                                            |
| 26      | 287137         | Panel, Front                                                     |
| 27      | 248352-0218    | Screw                                                            |
| 28      | 11-1202-13     | Kit Assy, Rack (includes items 2 thru 6, 8 thru 27,<br>plus 29.) |
| 29      | 287653         | Spring, Rack Lock                                                |



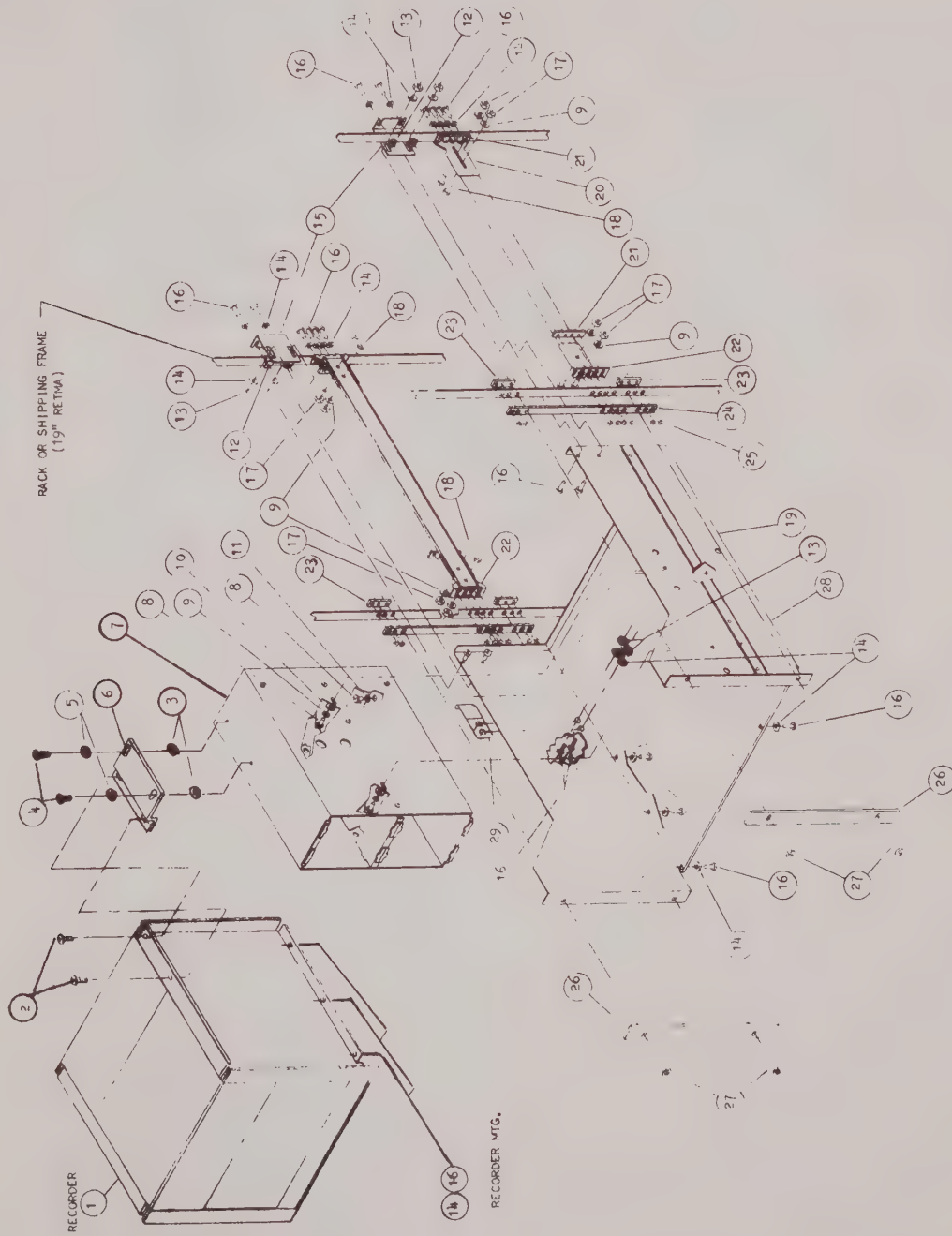


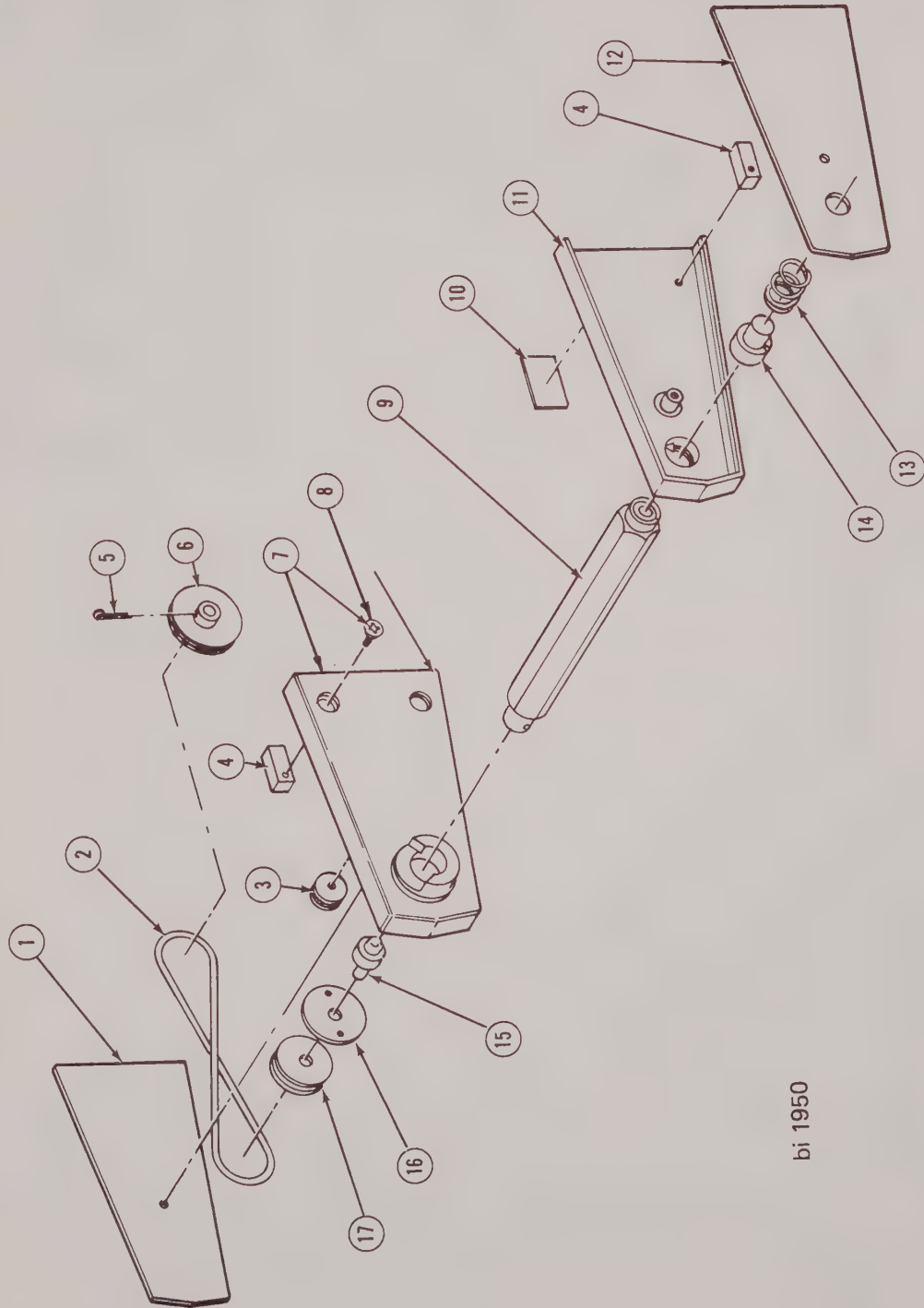
FIGURE 8-22 RACK MOUNT INSTALLATION INSTRUCTIONS - RECORDER WITH 4-CHANNEL PREAMP CAGE (687361)



EXPLODED VIEW PARTS LIST  
 2400 SERIES RECORDER — All models  
 CHART TAKEUP ASSEMBLY 11-6402-11  
 FIGURE 8-23

| ITEM<br>NO | PART<br>NUMBER | DESCRIPTION               |
|------------|----------------|---------------------------|
| 1          | 249617-4       | Plt. Cover - R            |
| 2          | 243867-12      | "O" Ring                  |
| 3          | 246651         | Roller, Guide             |
| 4          | 246307         | Block                     |
| 5          | 236865-3       | Cotter Pin                |
| 6          | 266046         | Pulley                    |
| 7          | 767254-5       | Arm Assembly, L.H.        |
| 8          | 9-249640-8206  | Screw Fl. Hd.             |
| 9          | 686704         | Shaft Assembly            |
| 10         | 247523-106     | Plate, Ident. Mod. No.    |
| 11         | 767249-5       | Arm, Right                |
| 12         | 249618-4       | Plate Cover - L.          |
| 13         | 267253         | Spring Compression        |
| 14         | 266184         | Shaft, Shouldered         |
| 15         | 667251         | Shaft Assembly Shouldered |
| 16         | 243696         | Retainer, Bearing         |
| 17         | 267257         | Pulley                    |





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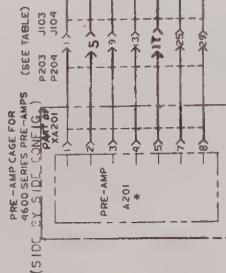
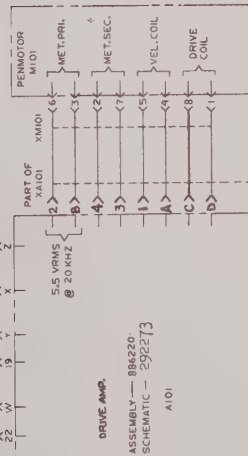
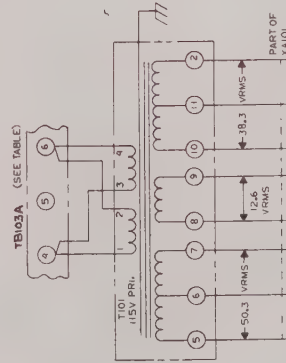
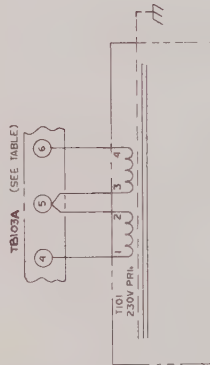
FIGURE 8-23 CHART TAKEUP ASSEMBLY







| REV. | REVISIONS                                                                                  | DATE    | BY        |
|------|--------------------------------------------------------------------------------------------|---------|-----------|
| 1    | A. DEC. WIRING TO COM-<br>PONENTS IDE OF 1600<br>PREF. STRIP<br>BARRIER STRIP<br>DCN 23090 | 9/24/71 | BAILEY    |
| 2    | DELETED CLOZE CR10H<br>11-007 DCN 23151                                                    | 9/23/71 | D. BAILEY |
| 3    | DELETED WIRE 5 (DRIVE<br>MOTOR B101)                                                       | 9/24/71 | BAILEY    |
| 4    | REVISED PER DCN 24016                                                                      | 9/24/71 | AK        |
| 5    | REVISED PER DCN 24330                                                                      | 9/24/71 | AK        |
| 6    | REVISED PER<br>DCN 24471 HAMILTON                                                          | 9/24/71 | AK        |
| 7    | REVISED PER<br>DCN 24916 D. BAILEY                                                         | 9/24/71 | AK        |
| 8    | REVISED PER DCN 24916 D. BAILEY                                                            | 9/24/71 | AK        |



| CHANNEL 1 THRU 8 CONNECTION TABLE<br>FOR 2400, 2600 & 2800 RECORDER |          |
|---------------------------------------------------------------------|----------|
| CHANNEL                                                             | TERMINAL |
| 1                                                                   | 4        |
| 2                                                                   | 7        |
| 3                                                                   | 10       |
| 4                                                                   | 3        |
| 5                                                                   | 1        |
| 6                                                                   | 4        |
| 7                                                                   | 7        |
| 8                                                                   | 10       |

CH. 1 W/10TH LINK REQ'D  
NO MM RES. ASSY 692370, R301  
50 MM SHORTING LINK  
100 MM NONE REQ'D



CHANNEL 1 SHOWN (TYP. 2 THRU 8 CHANNELS)

\* FOR 6 & 8 CH. RECORDER RACK MOUNTED  
CONFIGURATION, SEE WIRING DIAGRAM  
292226 (11-1200-15) FOR PRE-AMP TO  
DR. AMP. WIRING.

RECORDER ASS'Y.

THIS DRAWING IS USED  
BY OTHER GOULD DIVISIONS  
AND/OR LOCATIONS. A F

|      |         |             |                             |
|------|---------|-------------|-----------------------------|
| REV. | DATE    | NAME        | GOULD INC.                  |
| 1    | 9/24/71 | SCHEWATI    | Instrument Systems Division |
| 2    | 9/24/71 | 2000 SERIES | GOULD ELECTRONICS, INC.     |
| 3    | 9/24/71 | 96795       | 285851                      |
| 4    | 9/24/71 | 6           | 2 OF 2                      |

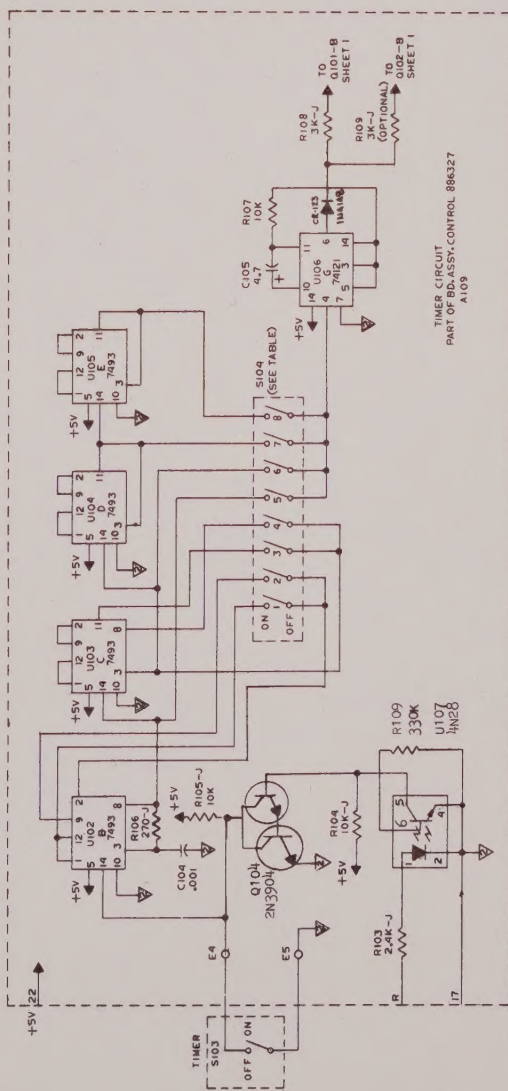












| LINE FREQ. | 50 HZ |           |       |           | 60 HZ |             |       |        | 400 HZ |        |       |        |
|------------|-------|-----------|-------|-----------|-------|-------------|-------|--------|--------|--------|-------|--------|
|            | SW ON | SW OFF    | SW ON | SW OFF    | SW ON | SW OFF      | SW ON | SW OFF | SW ON  | SW OFF | SW ON | SW OFF |
| 1. SEC     | 1 3 5 | 2 4 6 7 8 | 2 3 5 | 1 4 6 7 8 | 3 6   | 1 2 4 5 7 8 |       |        |        |        |       |        |
| 10.0 SEC   | 1 3 6 | 2 4 5 7 8 | 2 3 6 | 1 4 5 7 8 | 3 7   | 1 2 4 5 6 8 |       |        |        |        |       |        |
| 100.0 SEC  | 1 3 7 | 2 4 5 6 8 | 2 3 7 | 1 4 5 6 8 | 3 8   | 1 2 4 5 6 7 |       |        |        |        |       |        |
| 1.0 MIN    | 1 4 6 | 2 3 5 7 8 | 2 4 6 | 1 3 5 7 8 | 4 7   | 1 2 3 5 6 8 |       |        |        |        |       |        |
| 10.0 MIN   | 1 4 8 | 2 3 5 6 7 | 2 4 8 | 1 3 5 6 7 |       |             |       |        |        |        |       |        |





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